HIGH-POWER BACKYARD AEROBAT

SPIED>> FUTURE OF AIR WAR

page 162

MODEL Airplane NEWS

10 TOP ENGINES
Which .60 is best for you?

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MODEL Airplane NEWS

MAY 2003 VOLUME 131, NUMBER 5

ON THE COVER: piloted by Nick Ziroli Sr., the Great Planes Fokker Dr.1 triplane banks into a tight turn for the camera (photo by Walter Sidas).

FEATURES

CONSTRUCTION

FLIGHT TESTS

COLUMNS

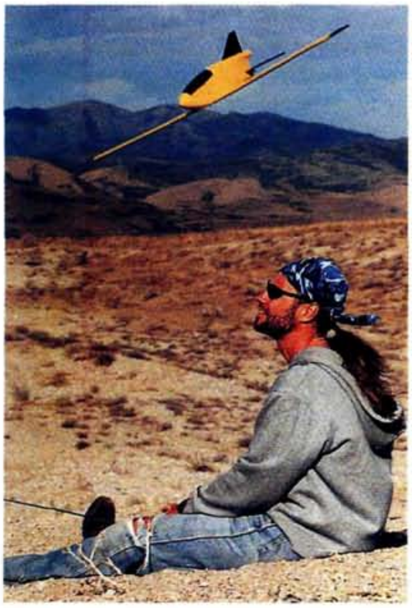
DEPARTMENTS

Engine exclusive

The next step up in power from .40-size engines, .60s can fly larger, higher performance planes and are the powerplants of choice for many of the latest almost-ready-to-fly (ARF) models. But how do you know which engine is best suited to your model? Stop guessing and check out this month's feature article, **"We Test 10 .60 Engines."** *Model Airplane News* columnist, book author and all-around engine guru Dave Gierke has spent the last few months putting 10 popular .60-size engines through their paces. Dave not only broke in, dyno-tested and took rpm readings on each engine with a comprehensive array of propellers, but he also tore down each one for an up-close look at the internal components. Want to know the truth about rpm, horsepower and torque? Turn to Dave's findings on page 28 to see which .60 is right for you!

PERFECT SCALE HINGES

We welcome Vance Mosher to our hangar of *Model Airplane News* "Scale Techniques" columnists this month. Because Vance likes his models to look and fly like their full-size counterparts, he pays a lot of attention to their details as well as to their overall appearance. This month, he describes **how to make and install friction-free scale hinges**—everything from Robart Hinge Points to homemade removable hinges that make it much easier to paint and repair your model. The success of your model may "hinge" on this!



KINGS OF THE HILL

When you combine one of America's most beautiful locales with graceful, scale, slope-soaring models, you're bound to have some great photo opportunities. In this issue, Rich Loud shares the spectacular shots he took at **Soar Utah 2002**—a scale sailplane event that spans three unbelievable soaring sites in the mountains around Salt Lake City. See his article on page 40 for the latest in scale sailplanes and to learn why these planes are really the "kings" of the hill.

EASY ENGINE INSTALLATION

Although many of today's ARF offerings come built, covered and hinged, one of the most important assembly steps remains for you to do: mount the engine. For your model to fly safely and well, **proper installation of your powerplant** is essential. This month, Erick Royer takes us step by step through how to position mounting holes in the firewall and rails to achieve a tight, vibration-free setup. His how-to article starts on page 78.

IN THE WORKSHOP

This month's construction article features a Golden Age racer with modern aerobatic performance. Designed by Dick Allen for IMAA scale competition as well as Golden Age fly-ins such as the annual Rhinebeck Jamboree, **the Miles Sparrowhawk** uses traditional balsa and ply construction. With a Zenoah G-62 in its nose, this model will undoubtedly turn heads at any flying field!

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WRITE TO US! We welcome your comments and suggestions. Letters should be addressed to "Airwaves," *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA; email man@airage.com. Letters may be edited for clarity and brevity. We regret that, owing to the tremendous numbers of letters we receive, we cannot respond to every one.

GAS ENGINE TROUBLE

I enjoyed reading your articles about Zenoah engines and the "Gas Engine Guide" in the May 2002 issue. I have an older Zenoah G-38, and my prop keeps spinning off, even though I tighten it securely. What's wrong? The engine sat for a few years, and now it always sounds as if it is running out of gas. Is the gas tank wrong, or does the carburetor need a rebuild?

JIM HALPIN
Milton, DE

Jim; with the few details you supply, it's difficult to know exactly what is wrong, but I'll tackle some of the basics for you. Be sure to use the large prop washer that comes with the engine. If you just tighten the bolt head against the prop, it might come loose while the engine is running. Also, be sure to use an attachment bolt that is long enough to secure the prop properly; the bolt should thread into the hub for at least an inch. You must also balance your prop. If it isn't balanced, it can cause enough vibration to loosen even the tightest bolts.

Your engine should not sound as if it's struggling to get gasoline. If it does, it might be tuned too lean. You shouldn't have to rebuild the carb if it is pumping fuel properly and your engine starts without difficulty. The high- or low-end needle valve has probably been set too lean. Close both of them completely, and then open them 1¼ turns out (turning counterclockwise) and run your engine. This will be a good place to start. See the "Gasoline Engine Guide" in the May 2002 issue for details on proper carb tuning. Also make sure that your fuel lines and gas tank are clean and equipped with gasoline-compatible hardware and tubing. GY

FUEL QUESTION

I read Dave Gierke's article on break-in and decided to use his method to break in my Rossi 23R40 2-stroke. Our hobby shop sells two popular fuels, but their labels don't indicate their oil content. One has all-synthetic oil, and the other is a synthetic/castor blend. Could I assume 18 percent oil and add enough castor to bring it up to 20 percent? [email]

FLOYD MAIDMENT

Floyd; you could add castor oil to these fuels, but how much? Why "assume" anything? Switch to a fuel whose manufacturer divulges its lubricant

slimlineproducts.com

More Smoke, Less Fluid... with PFT

percentages. Red Max, Wildcat and Sig list their fuels' ingredients and percentages on their labels. Why take the chance of running too little lubricating oil in your new engine? Dave Gierke

MORE 3D AEROBATICS!

Wow! I'm not sure I could ever pull off the "roller-coaster" [Quique Somenzini's freestyle maneuver described in the April 2003 issue], but I am in awe of his incredible aerobatics skills, and I really enjoyed reading his article. I'm looking forward to his articles on freestyle techniques; I want to pick up a few pointers so I'll be able to show up my buddies at the flying field! [email]

ART DERRY

Thanks for letting us know how much you enjoyed Quique's article, Art. More high-end aerobatics articles are in the works; stay tuned! (And what makes you think your "buddies" didn't read Quique's article, too!) DS

PAINT PREP

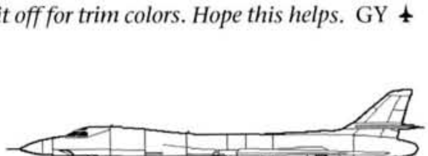
You guys must know of all the great products that are on the market, so I hope you can help me. Other than a fiberglass cloth and polyester resin finish, which covering material would you recommend to cover a model that I would like to paint? [email]

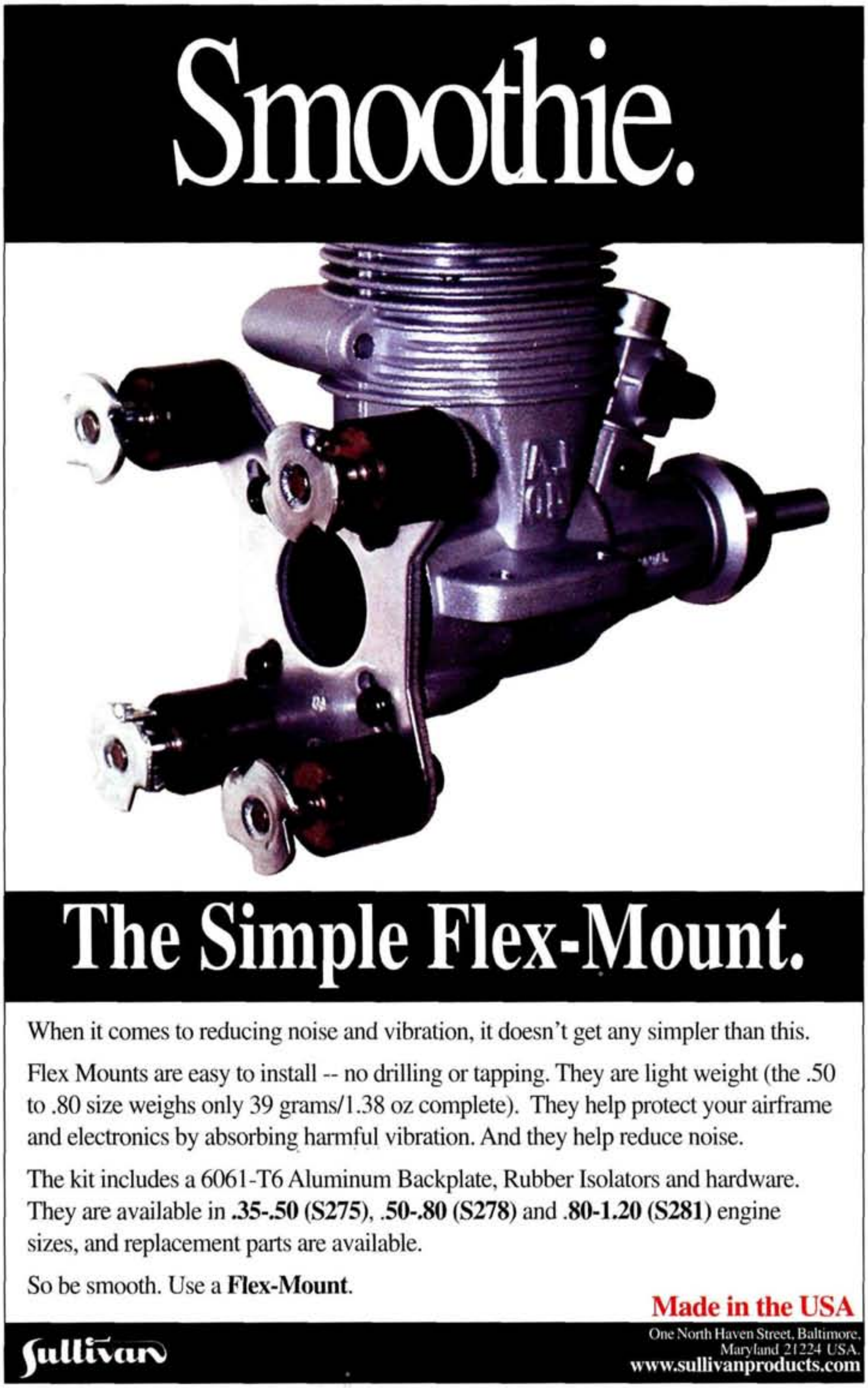
ED SROKA

Hi, Ed. There are several alternatives to a fiberglass and polyester resin finish. The first that comes to mind is a fiberglass and epoxy resin finish. There are several brands, and I've used Pacer Technology's Finishing Resin. It is very easy to apply and to sand, and it's available at most hobby shops. Alternatively, you could use a water-based polyurethane varnish in place of the resin. Products used to refinish wood floors, e.g., Minwax and Red Devil, are very easy to apply; just position the glass cloth and brush the varnish on. It does take a little longer to dry, but it doesn't have that offensive odor.

If you want to avoid using fiberglass cloth altogether, consider F&M Enterprises' Stits Lite finishing system. A heat-shrinkable cloth and adhesive covers the model, and then a specially formulated primer and paint produce the final finish (F&M Enterprises [817] 279-8045; stits.com).

Though not as durable as the other techniques, you can also paint over Mylar film coverings such as MonoKote and Ultracote. Just clean the surface thoroughly, lightly scuff it with fine steel wool, wipe it with a tack cloth, and then use a fuelproof spray paint. Let the paint dry for several days before you mask it off for trim colors. Hope this helps. GY





AIR SCOOP

by the Model Airplane News *crew*

NEW PRODUCTS OR PEOPLE hit the model airplane market all the time, so here's the inside source for what's hot and where you can get it. Every issue, we sift through product announcements, show reports, rumors and prototypes to let you in on the best and the latest. Remember, you saw it here first!

HANGAR 9
XTRA EASY 2

Learning to fly just got easier with Hangar 9's newest RTF trainer. In less than one hour of simple bolt-on, slide-in assembly, you can take to the skies! The Xtra Easy 2 is larger than its predecessor for better handling and slower flights. The Ultracote-covered model comes with an installed 5-channel, JR computer radio and the Evolution Trainer Power System, with a factory-mounted and broken-in engine that's tuned for maximum performance. After you've mastered the basics, add a camera mount and piggyback sailplane launch (available separately). Specs: wingspan—69 in.; wing area—793 sq. in.; length—55 in.; weight—6.25 to 7 lb. The Xtra Easy 2 sells for $379.99.

Hangar 9; distributed by Horizon Hobby Inc. (800) 338-4639; horizonhobby.com.

SLIMLINE PRODUCTS
showtime PFT SMOKE PUMP

Want to make your mark in the sky? Install the new Showtime PFT (programmable flow technology) smoke pump in your plane, and you can precisely control the flow rate of smoke fluid with your transmitter. This allows you to use a much smaller smoke tank (saving weight and fluid), and you can mix the smoke-flow rate with other channels, such as throttle, to give a denser smoke trail as the plane's speed increases. The Showtime PFT unit incorporates a new, ultrasonic, welded pump head that will never leak, with an enclosed, rechargeable, 600mAh NiMH battery power supply. The $159 pump comes with all the mounting hardware and the F-1 smoke-tank system.

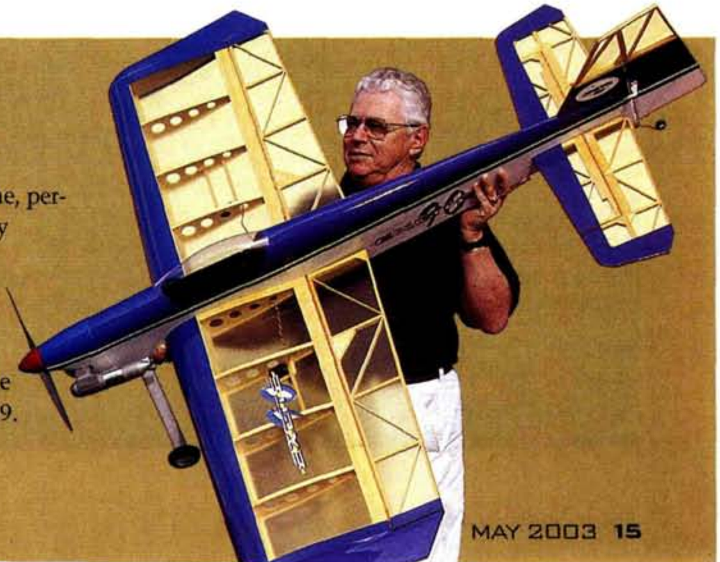
Slimline Mfg. (480) 967-5053; slimlineproducts.com.

CERMARK
PITTS S2B

Looking for a classic aerobatic biplane? Then the new Signature Series Pitts S2B may be the ARF for you. Ultracote covering, a tinted canopy, painted landing gear, painted fiberglass parts and a complete hardware package make this a complete kit for $349.95. The Pitts also features simple I-strut mounting and a reinforced firewall with an exchangeable engine mount to fit a .90 2-stroke, a 1.20 to 1.40 4-stroke, or a G-23 gas engine. Specs: wingspan—60 in.; length—58.5 in.; flying weight—9.5 to 10.5 lb.; radio required—4-channel w/7 servos.

Cermark (562) 906-0808; cermark.com.

MODEL TECH
EXCITE 90L ARF



This plane has an incredible power-to-weight ratio and can fly with a .46 engine, performs freestyle aerobatics with a .60, and it amazes onlookers when powered by a Magnum 91XLS. The model features all-wood construction, iron-on covering, aluminum landing gear with a steerable tailwheel, clear canopy, pull/pull rudder control and a complete hardware package. Specs: wingspan—61 in.; wing area—1,100 sq. in.; length—68 in.; weight—7 to 7.5 lb.; wing loading—14.5 to 16 oz./sq. ft.; radio required—4-channel, w/5 high-torque servos; engine recommended—.60 to .91 2-stroke. The Excite has a street price of only $219.99.

Model Tech; distributed exclusively by Global Hobby Distributors (714) 963-0133; globalhobby.com.

HOUSE OF BALSA
AT-6

Designed from Nick Ziroli Sr. plans that were featured in the Fall 2002 issue of *Backyard Flyer*, this zippy electric kit includes: all balsa and plywood construction; color, photo-illustrated instructions; full-size plans; laser-cut parts; self-adhesive Mylar decals and Du-Bro hardware. Specs: wingspan—35.25 in.; wing area—196 sq. in.; weight—18 oz.; wing loading—13.22 oz./sq. ft.; length—24.25 in.; radio—4-channel w/3 microservos; motor recommended—AstroFlight 010 brushless or Speed 400. This kit is so new, House of Balsa hasn't even priced it yet!

House of Balsa (760) 246-6462; houseofbalsa.com.

CENTURY HELICOPTER PRODUCTS
Robinson R22HP

An ideal ⅕-scale project for intermediate helicopter pilots, this ARF heli is designed with a special gear ratio of 10.6:1 that produces a low head rpm for high lift with low drag and a smooth, scale blade noise. Other features of this modular ARF are collective/cyclic pitch mixing for direct servo-to-swashplate control, painted epoxy/glass cabin, tail fins and a clear windshield. Specs: main rotor—58 in.; length—47 in.; height—19 in.; weight—7.75 lb.; engine recommended—.50 2-stroke. The R22HP retails for $549.95. Century also offers two scale packages for the Robinson; each retails for $44.95.

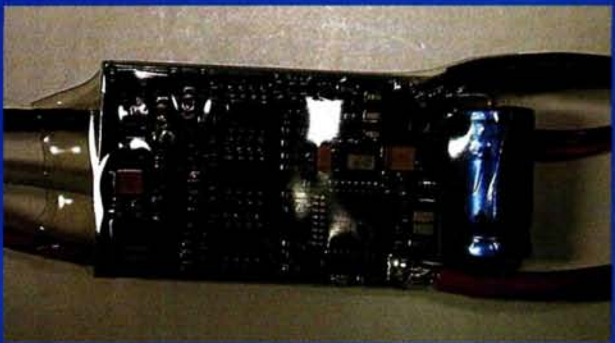
Century Helicopter Products (800) 686-8588; centuryheli.com.

MODEL MACHINING SERVICE
MMS GEAR DRIVE

Need to swing a larger prop on that scale electric plane? Model Machining Service offers a new MMS gear drive that's intended for direct-drive motors with low rpm. The gearbox is sealed to prevent debris from fouling the inner workings. The gear ratio can be changed to 1.5:1, 2:1, or 2.5:1 by pressing a different pinion gear onto the motor. Specs: length—2 in.; diameter—1.75 in.; weight—3 oz. The gear drive costs $75, and extra pinion gears are $6 each.

Model Machining Service (949) 631-2982; innerdemon.com.

CASTLE CREATIONS
Phoenix-45



The newest brushless controller in the Phoenix lineup introduces a programmable option with an adjustable switching rate! Now you can get the most efficient setup possible because the Phoenix-45 offers three choices of switching rates. You can fine-tune control features such as cutoff voltage, current limiting, brake type, throttle type, electronic timing advance and cutoff type. Other features include over-current and -temperature protection, BEC, a safe-arming program and simple setup. It retails for $119.95.

Castle Creations (785) 883-4519; castlecreations.com.

PACIFIC AEROMODEL MFG. INC.

EDGE 540T

Take your pick between the new .40 and .60 Edge 540Ts. Both kits feature all-wood construction and come with painted fiberglass cowls and complete hardware packages as well as plug-in wings, dual aileron servos, tail-mounted elevator servos and pull/pull rudders. Specs: .40/.60: wingspan—59/65 in.; length—52.5/58.5 in.; flying weight—6 to 8 lb.; engine recommended—.40 to .53 2-stroke, .56 to .72 4-stroke, .61 to .91 2-stroke, and .80 to 1.00 4-stroke; radio required—4-channel w/5 servos. The .40 model costs $209.99, and the .60 costs $269.99.

Pacific Aeromodel Mfg. Inc. (800) 780-0100; pacaeromodel.com.

PLANRITE TRADING CO. LTD.

DSP 4-SC MICRO RECEIVER WITH ESC

Weighing only 8 grams, this 4-channel FM receiver has a built-in 10A speed control! The narrowband unit is compatible with Futaba and Hitec transmitters (negative shift) and has a range of up to 1 mile. With its digital signal processing, the receiver weeds out noise and interference and allows only clear, clean signals to reach your servos and motor. The built-in speed control has ramp-up, ramp-down filtering to ensure that motor speed will smoothly increase and decrease, thereby reducing motor and gearbox stress. The DSP 4-SC can be used with a single lithium cell or a 2.5 to 18V battery pack. Dimensions—0.625x1.5x0.5 in. Price (including crystal) is $59.95.

Planrite Trading Co. Ltd. (306) 955-1836; plantraco.com.

WEBRA

1.45 Aero

Webra is well known for its line of high-performance airplane engines, and its new 1.45 continues the tradition. With an excellent thrust-to-weight ratio, the 1.45 Aero incorporates an integral fuel pump that ensures fuel flow to the engine no matter what attitude your plane is in. For the ultimate in performance and control, Webra offers an electronic-onboard-mixture-control option. Prices—$399.99 (1.45 Aero engine); $82.99 (Active Mixture Control).

Webra; distributed by Horizon Hobby Inc. (800) 338-4639; horizonhobby.com.

J&Z PRODUCTS INC.

Pro Zinger

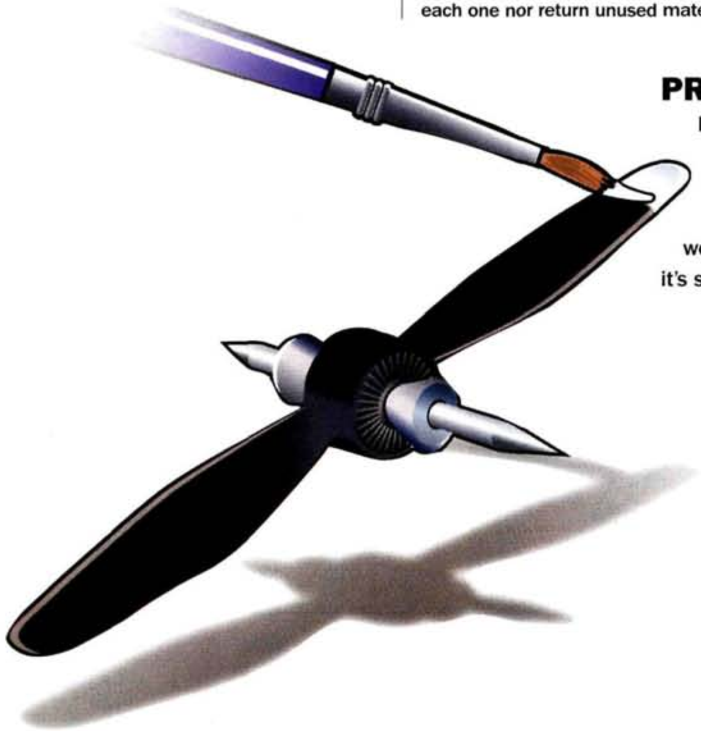
Is your prop looking a little worn? Check out the new Pro Zinger line from J&Z Products. This line was designed for competitive fliers who need the highest performance and reliability, but the occasional Sunday flier will also appreciate its attributes. Pro Zingers are available in sizes from 12x6 to 32x12, and they cost from $4.69 to $66.59.

J&Z Products Inc. (310) 539-2313; zingerpropeller.com.

TIPS & TRICKS

Illustrations by David Baker

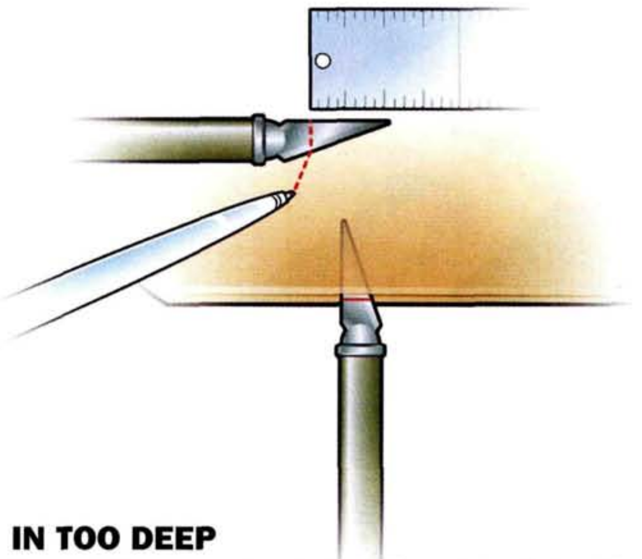
SEND IN YOUR IDEAS. *Model Airplane News* will give a free, one-year subscription (or a one-year renewal, if you already subscribe) for each idea used in "Tips & Tricks." Send a rough sketch to *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA. BE SURE YOUR NAME AND ADDRESS ARE CLEARLY PRINTED ON EACH SKETCH, PHOTO AND NOTE YOU SUBMIT. Because of the number of ideas we receive, we can neither acknowledge each one nor return unused material.



PROPELLER SAFETY

It's always a sound practice to balance your propeller before you install it on your airplane. With today's composite props, it's a good idea to add weight to the lighter blade instead of removing material from the heavier blade. A dab or two of white or yellow enamel paint works well as extra weight, and it also makes the prop tip highly visible while it's spinning—an important safety plus.

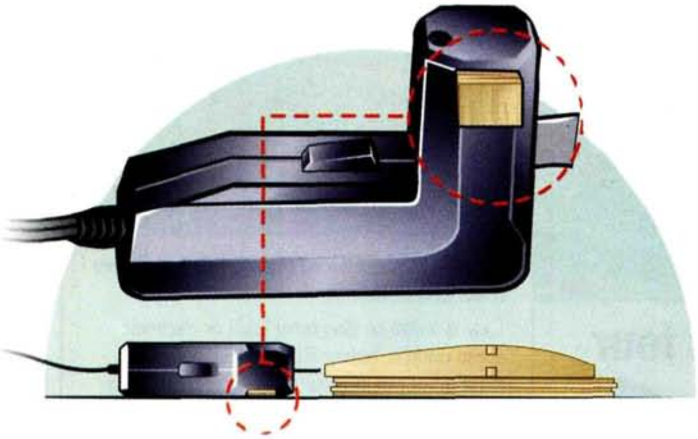
Michele Spirito, Casagiove, Italy



PERFECT HINGE SLOTS

The Great Planes Slot Machine makes it easy to cut CA hinge slots, but if it wanders, the hinge slots won't be centered in the piece. To consistently center the slots, glue a hardwood block to the Slot Machine; make sure it's parallel to your work surface. After you've marked the hinge locations, prop up the piece you plan to slot to the proper height. You'll now find it easy to cut the hinge slots exactly where you want them.

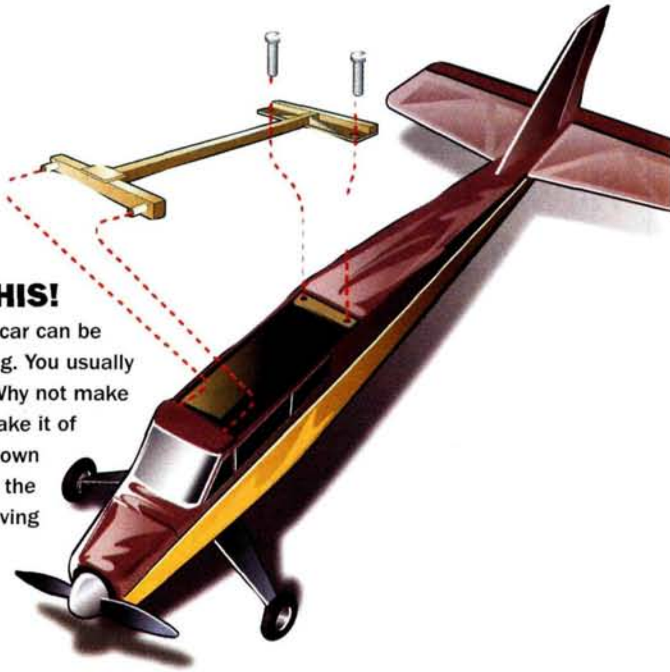
Charles Reich, Franksville, WI



IN TOO DEEP

If you cut hinge slots using a hobby knife, you know that making slots of the correct depth is a hit-and-miss operation. Here's a solution: using a straightedge or a tape measure, lay the knife-blade point to the depth required (the blade must be parallel with the straightedge), and use a permanent-ink marker to draw a line straight across the blade where it enters the wood. The line on the blade indicates when it's at the correct depth.

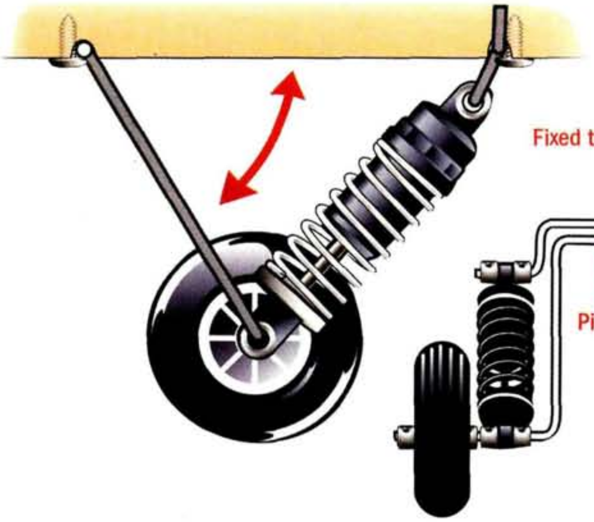
Ben Davis, St John's, Newfoundland, Canada



GRAB THIS!

Carrying a fuselage from your workshop to your car can be hazardous, especially if it's large or particularly long. You usually have to support it under the nose and at the tail. Why not make a simple handle and mount it on the fuselage? Make it of plywood that can be plugged into the wing hold-down dowel holes and then secured to the fuselage with the wing bolts. You'll also find the handle great for moving the fuselage around during its construction.

Walter Grabinsky, Barrie, Ontario, Canada



SMOOTH LANDINGS

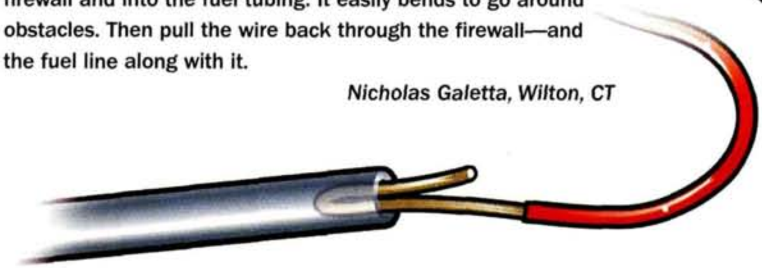
Full-size airplanes use shock absorbers to smooth out bumpy landings, so why not use shocks on our models' landing gear to do the same thing? It's easy to add an RC car shock absorber to your wing's landing gear simply by attaching it to the gear's axle and removing the torsion bar from the landing gear so that the gear will still be able to pivot. Add a second wire from the top of the shock to the rear of the wing; make sure that it's mounted on securely. This system will work on models of all sizes.

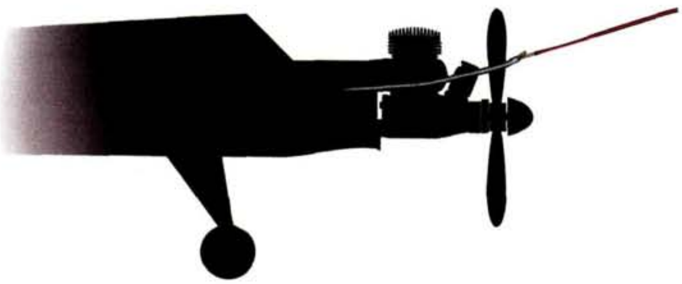
Jim Finn, Damascus, MD

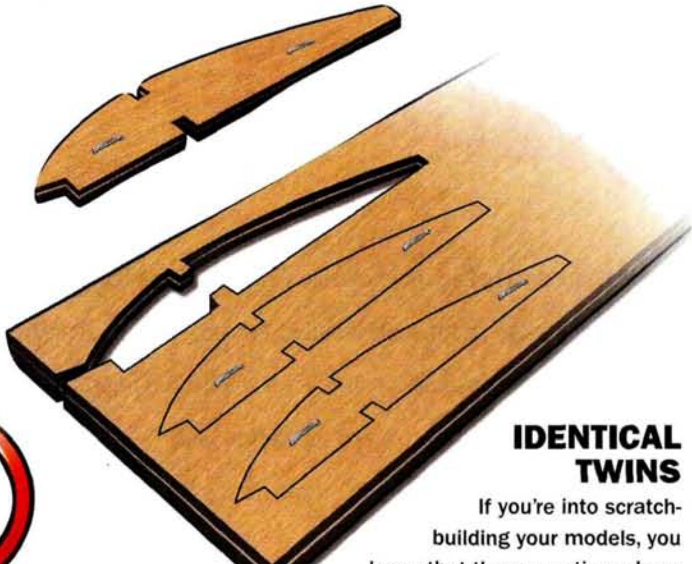
COPPER WIRE TO THE RESCUE

Fuel tanks must be removed from time to time for maintenance, or they may develop a leak that must be repaired. Removing the tank from the fuselage is rarely a problem, but reinstalling it and snaking the fuel lines through the firewall can be. Here's an easy solution: fold a couple of inches of approximately 2 feet of soft copper bus-bar wire (0.050 to 0.060-inch diameter) back on itself. Slide the wire through the firewall and into the fuel tubing. It easily bends to go around obstacles. Then pull the wire back through the firewall—and the fuel line along with it.

Nicholas Galetta, Wilton, CT







IDENTICAL TWINS

If you're into scratch-building your models, you know that they sometimes have a tapered or elliptical wing. This means that the ribs will be of different shapes and sizes, and you won't be able to stack them and cut them all out at once, as is usually the case. Here's a way to make pairs of ribs. Trace the rib patterns onto the appropriate sheet balsa and then stack two sheets. Staple the sheets together, putting two staples in each rib pair. While they're stapled, cut out each pair of ribs and sand them to their final shape. Remove the staples, and you'll have pairs of identical ribs.

Jim Silva, Portland, OR

EASY CLEVIS RETAINERS

Most modelers use a short piece of fuel-line tubing as a retainer over the end of a clevis to ensure that it stays closed. After a hard season of flying, the tubing may be fatigued and break off. It can be very difficult and challenging to stretch a new piece of tubing over the clevis. Why not slip a couple of extra pieces of tubing onto the pushrod before you install the clevis on it? Then, when your tubing breaks off, you'll have a replacement on hand and ready to go.

Greg Gavit, Freeland, MI

SEND IN YOUR SNAPSHOTS. *Model Airplane News* is your magazine and, as always, we encourage reader participation. In "Pilot Projects," we feature pictures from you—our readers. Both color slides and color prints are acceptable, but please do not send digital printouts. We receive so many photographs that we are unable to return them. All photos used in this section will be eligible for a grand prize of $500, to be awarded at the end of the year. The winner will be chosen from all entries published, so get a photo or two plus a brief description, and send them in! Send those pictures to "Pilot Projects," *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA.

Jack Goodrich
Sterling Heights, MI
P-26 PEASHOOTER

Jack's plane is a Giantscaleplanes.com fiberglass kit of the Boeing P-26 Peashooter. The colorful paint scheme is only the beginning with this scale trainer; sharp eyes will notice scale flying wires, a dummy radial engine and a custom dual bomb drop on its belly. The model has a 71-inch wingspan and is powered by an MDS .68 engine. Jack reports that one of his reasons for building a Peashooter was its distinction as the first plane to shoot down a Japanese Zero, despite being out of date by the time WW II began.

David Ormsby
London, Ontario, Canada
HEAVENLY HELLCAT

This F6F-5 Hellcat is David's first attempt at building a model from plans, and we say he's off to a pretty decent start. The 58-inch model is from an Eric Fearnley plan sold by *Model Airplane News* (no. FSP03772). David's Hellcat weighs just over 8 pounds, and he powers it with a Magnum .61. He modeled the trim scheme after Hellcat no. 34 that was assigned to VF-29 on board the USS Cabot during WW II. David chose it because he reports that the squadron scored 114 kills and produced 12 aces during its stint in the Pacific theater.

Gene Davis, Palm Bay, FL
COMIC HERO SKYROCKET

Gene was a fan of the Black Hawk comic book of the '40s and '50s, as can be seen by his 60-inch-wingspan Grumman XF5F-1 Skyrocket built from Rich Uravitch plans. The Skyrocket was the first plane Black Hawk flew in the comic, and Gene has faithfully re-created the aircraft from its pages, right down to a Black Hawk pilot figure and pairs of .50-caliber and 20mm guns in the nose. Gene's model weighs 7¼ pounds and is powered by two O.S. 35FP engines with Slimline Pitts mufflers.

Phil Camp, Queensbury, NY
YELLOW AIRCRAFT ZERO

We knew we had to include this A6M5 Zero from Yellow Aircraft when we saw the detail Phil put in the cockpit (the rest of the plane isn't too shabby either!). With its retracts, the beautiful, scale cockpit kit, a CyToys Japanese pilot and a sliding canopy, you might suspect that this 80-inch model weighs more than the full-size fighter did, but Phil tells us it tips the scales at a very reasonable 26 pounds. The Zenoah G-62 has plenty of grunt to motor this beauty around the sky. Phil relies on a Futaba radio and a mix of Futaba, Hitec and FMA servos.

Jim Hauck
Pendleton, SC
TRI-MOTOR KADET

Three engines, two displacements, one airplane. How could we resist putting it in "Pilot Projects"? Jim did a little arithmetic and figured that two .26s equal one .52, but why settle for one or two when he could have all three? He grafted two O.S. .26 4-strokes to the wing of his Sig Senior Kadet, which sports a Magnum .52 4-stroke in the stock location. He made the engine nacelles out of Tupperware containers; the rest of the plane is covered in MonoKote. Jim reports that the sound of three 4-strokes alone is worth the effort; that it's a great-flying, entry-level, multi-engine model is just gravy!

Robert Brough
Aspers, PA
DOUGLAS DOLPHIN

Robert tells us he spent a couple of years building and dialing in his mammoth Douglas Dolphin, but after one look at it powering majestically off the water, he knew it was worth the time. The amphibious craft has a 10-foot wingspan and weighs in at 42 pounds. It is balsa, ply and spruce, covered with Sig Koverall and butyrate dope. To get all that airplane off the lake, Robert employs a pair of SuperTigre 3250s spinning Master Airscrew 18x8 propellers. Robert has bolt-on landing gear in case he ever gets tired of flying off the lake, but we're betting he won't!

Rick Knight
Las Vegas, NV
¼-SCALE EDGE 540

This ¼-scale Edge 540 from an Aeroworks kit is Rick's first scale model, and its MVVS 1.6 is his first gas engine. He reports that the combination works well for him; there's plenty of power and maneuverability for IMAC aerobatics, and the gas engine is quite economical to operate. Rick relies on JR radio gear to control the 540 as he runs it through its paces at his regular flying site, the Apex Dry Lake.

Marty Cane
West End, NC
DELTA VORTEX

Deltas are cool, especially when they are as big as and fly as well as this Bruce Tharpe Engineering Delta Vortex kit. It spans 54 inches, and because it has almost 1,400 square inches of wing area, we aren't at all surprised to hear from Marty how gently it flies. Of course, with an O.S. .91 4-stroke and a 14x6 prop on the nose, it can get up and go when he wants it to. The model is covered with MonoKote, and Marty favors a Futaba 6XA for control.

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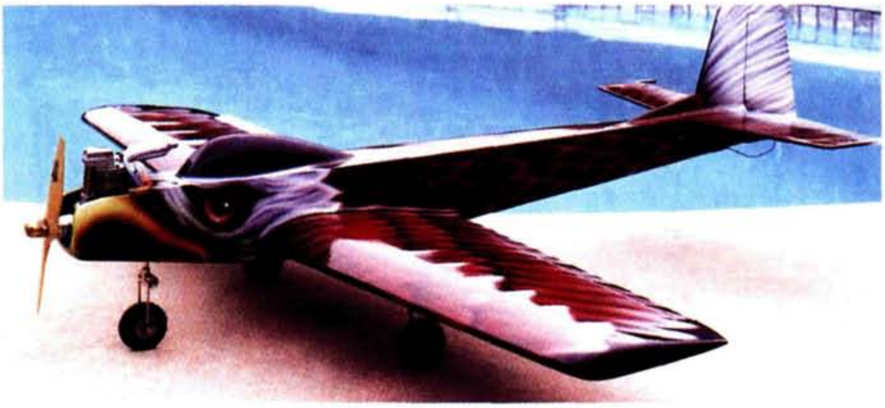
Huey Mitchell
Columbus, GA
RARE BIRD

Bet you've never seen a Tower Hobbies Kaos 40 that looks like this! Huey Mitchell covered the plane and fiberglassed the fuselage in preparation for a truly distinctive paint scheme. He used an airbrush to create this striking eagle design, and then he clearcoated it to preserve all the hard work that went into the finish. Huey powers his baby with an O.S. Surpass .70 4-stroke. Imagine the double takes this bird elicits when Huey flies it at the local field.



Peter Szekeres
Waianae, HI
HUGHES 500 RESCUE

Have you ever seen a nice scale model in a toy shop and wished that they had made it RC? Well, Peter decided that if the manufacturer wouldn't do it, he would take it upon himself to convert this Fire/Rescue Hughes 500 Little Bird from 21st Century Toys to RC. He hollowed out the center and hung the body shell on his Kyosho Nexus chassis. He even rerouted the exhaust so it would exit from the scale location on the body. Peter is working on motorizing the winch for the rescue basket. He also notes that the heli has strobes and a spotlight, opening doors, control yokes and a full instrument panel. He reports that it flies decently with the original .30 engine, but he plans an upgrade to a .46 so it will be able to handle the extra weight of the body and accessories better—and the rescue crewman that hangs from the bottom! ✈

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We test 10 .60 ENGINES Which is right for you?

We all want value for our money, but when it comes to evaluating RC engines, which criteria should we use to determine value? Cost? Performance? Warranty? Durability? Manufacturer and distributor reputation? Availability of parts? Service? Some of this information is relatively easy to obtain, but the rest is not as easy.

by Dave Gierke

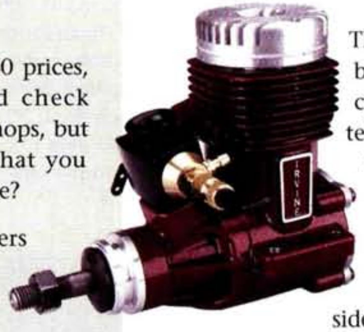
■ **Cost.** Search for the best .60 prices, look at magazine ads, and check discount houses and hobby shops, but consider this: are you sure that you want the least expensive engine?

■ **Performance.** Manufacturers usually don't include horsepower data and never consider torque. Then there's the matter of truthfulness; engine reviewers such as yours truly evaluate a limited number of engines a year; more than 600 are available worldwide!

■ **Warranty.** Most manufacturers offer a limited replacement policy to cover defective parts and workmanship; a few offer full replacement for any reason, including crash damage!

■ **Durability.** This is very subjective; circumstances play a large role, e.g., if you consistently set the needle valve too lean and/or use bargain-basement fuel of questionable content, your engine may wear out quickly—or suddenly! Likewise, if you buy an engine made of inferior materials or inadequately prepared components, you might need a new one before you're ready.

■ **Manufacturer's reputation, service and availability of parts.** When the manufacturer or distributor is respected and has a history of acting honorably (word travels fast), you can expect fair prices for repair service and parts when you need them.



THE MISSION

This analysis of 10 popular, low- to intermediate-price .60 engines is based on cost, performance, durability and warranty. All are 2-stroke-cycle, have single cylinders, use the front-rotary-valve induction systems with rotary-barrel carburetors, have side exhausts and are fitted with non-tuned expansion-chamber mufflers. Two of the group were first designed, produced and sold decades ago.

Certain design features, fabrication techniques and materials are similar for each engine; rather than repeat these in each review, I'll discuss them now, with deviations addressed in the "At a Glance" sidebar for each engine.

■ **ABC- or ABN-type piston and cylinder-sleeve.** All engines are either ABC (aluminum piston, brass cylinder sleeve and chrome-plated) or ABN (aluminum piston, brass cylinder sleeve and nickel-plated).

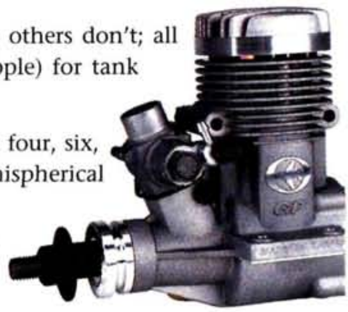
■ **Ringless (lapped) pistons are made of silicon-aluminum alloy.** ABC assemblies offer two primary advantages over ringed aluminum pistons that have steel or iron cylinder sleeves: a relatively short break-in period and a reduced incidence of piston damage during prolonged lean, high-temperature running.

■ **Cylinder-sleeve ports.** All 10 engines use Schnuerle ports with boost transfer ports, including a single or double (bridged) exhaust port.

■ **Wristpin supported by a film of oil within the piston bosses (free floating).** Made of alloy steel, they're bored for lightness, hardened for durability and precision-ground to final size; with the exception of two engines, they are retained within the piston by music-wire clips that snap into shallow grooves.

■ **Connecting rod** made of bronze-bushed aluminum alloy with a single lubricating hole at the wristpin end and two holes at the crankpin end.

■ **Crankshaft.** With the exception of one engine, the steel-alloy cranks are machined, one-piece, surface-hardened and ground to final size; with the exception of two engines, they have 5⁄16x24 nose threads.

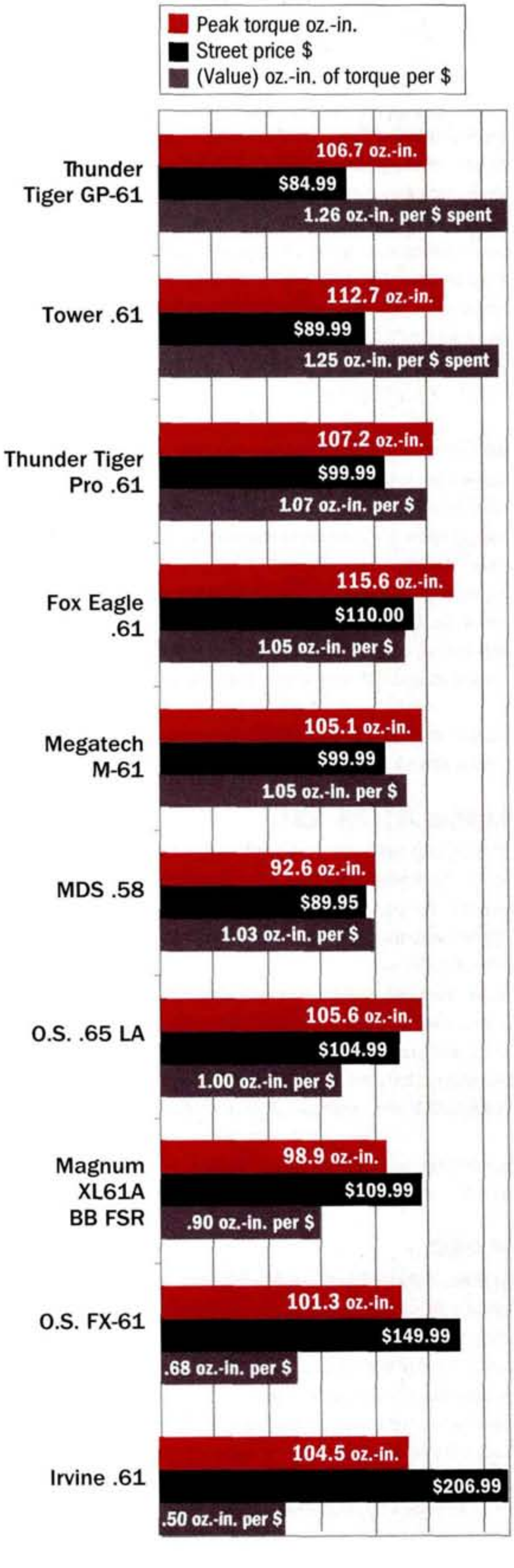


■ **Muffler.** Some use a baffle and provide sealing gaskets, others don't; all have positionable exhaust outlets and a brass fitting (nipple) for tank pressurization.

■ **Cylinder head.** Units are fastened to the crankcase with four, six, or eight machine screws; heads use the squish band/hemispherical combustion chamber design.

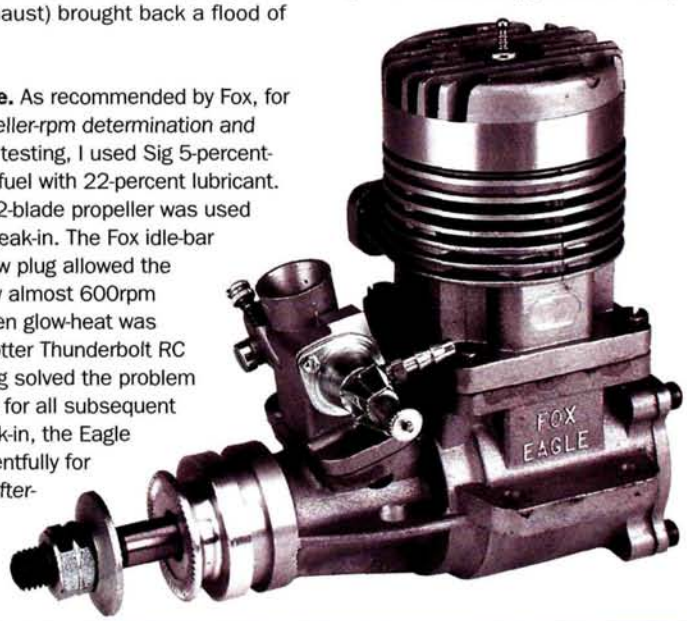
■ **Crankshaft is supported by bushings** (plain bearings) or dual ball bearings.

TORQUE PER DOLLAR SPENT



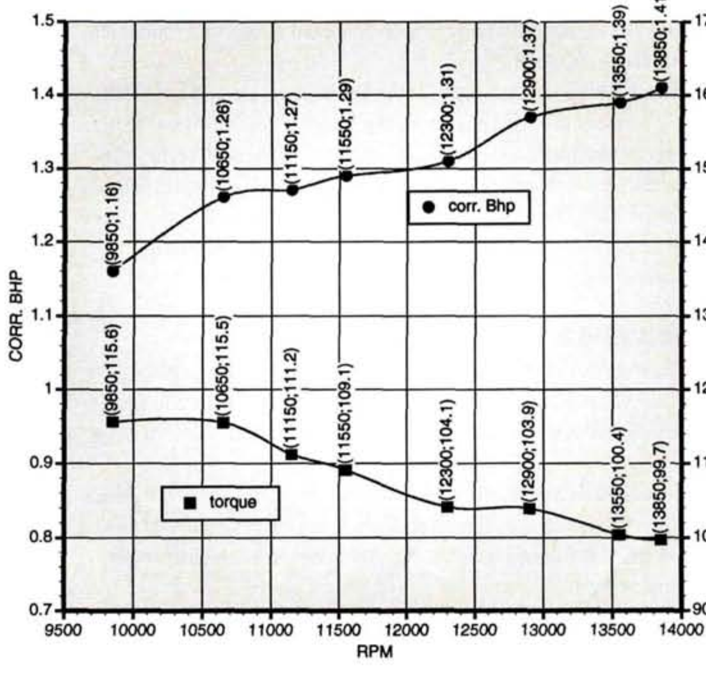
Fox Eagle .61 ABC

General impressions. The Fox Eagle design has been around since 1979, and it looked ancient back then! Disassembling the current Eagle reminded me of tearing down a postwar Hornet .60 racing engine: its two-piece crankcase (split horizontally below the exhaust) brought back a flood of memories.



• **Performance.** As recommended by Fox, for *break-in, propeller-rpm determination and* dynamometer testing, I used Sig 5-percent-nitromethane fuel with 22-percent lubricant. An APC 11x6 2-blade propeller was used for low-load break-in. The Fox idle-bar long-reach glow plug allowed the engine to slow almost 600rpm from peak when glow-heat was removed; a hotter Thunderbolt RC long-reach plug solved the problem and was used for all subsequent runs. For break-in, the Eagle was run uneventfully for 20 minutes; afterward, it peaked at a strong 13,850rpm.

Fox Eagle .61 ABC	Dynamometer-generated torque and horsepower curves indicate:
Temp. 65 deg. F	· torque peak—115.6 oz.-in. @ 9,850rpm (rank: 1st)
Bar. pres. -29.60 in. Hg	· corrected bhp peak—1.41 @ 13,850rpm (rank: 2nd)
Wet-bulb temp. -60 deg. F	· specific torque (oz.-in./ci)—190 (rank: 1st)
Corr. fact. -1.03	· specific horsepower (bhp/ci)—2.31 (rank: 2nd)
	· torque-to-weight ratio (oz.-in./lb.)—82 (rank: 1st)
	· horsepower to weight (bhp/lb.)—1 (rank: 2nd)



At a glance

Fox Eagle .61 ABC

Fox engines have often been criticized for their rough appearance, and it's true that the company has been more concerned with power than looks. Although this engine has most of the desirable components, including a true chrome/brass cylinder sleeve, twin ball bearings, etc., it's a very unconventional design.

Performance comparison. This powerplant came first in the torque, specific torque and torque-to-weight ratio tests. It was second in bhp, specific horsepower and horsepower-to-weight ratio. This performance was produced with the least powerful fuel (5 percent nitromethane) and the fourth smallest carburetor-choke bore; the engine/muffler combination is the third lightest. The Eagle is the easiest engine to start when hot and the smoothest running overall. It's also the loudest engine/muffler combo tested.

Idle: excellent at 2,400rpm; **midrange:** crisp acceleration to wide-open throttle; **best props:** APC 12.5x9, APC 13x7, APC 11x10, APC 12x8. **Price $110**

Irvine .61 MK II ABC

The Irvine .61 crankcase's glossy, maroon, baked-on finish is beautiful! The true-chrome/brass cylinder sleeve is part of the engine's ABC subassembly; twin ball bearings support the crankshaft; the slick, 2-needle, fuel-metering carburetor is made of bar-stock aluminum and anodized black; its rotary barrel and needles are made of hardened, precision-ground steel, and its other components are brass.

Performance comparison. The second largest carburetor-choke bore helped the Irvine .61 to crank out the third highest bhp and specific horsepower. Unfortunately, it's the second heaviest engine/muffler combination tested, and that accounts for its mediocre torque-to-weight and horsepower-to-weight rankings (ninth and sixth, respectively). It was the second loudest engine/muffler combination tested.

Idle: good at 2,500rpm; **midrange:** rich, hesitant acceleration to wide-open throttle; **best props:** APC 13x7, APC 12x8, APC 11x11. **Price $206.99**

Magnum XL61A BB FSR

This has several desirable features, including a ball-bearing-supported crankshaft, a fuel-metering carburetor and chrome plating for the brass cylinder sleeve (ABC); some machine-tool operations are rough, as is the engine's general appearance.

Performance comparison. With the largest carburetor-choke bore, the Magnum XL61A ranks in the bottom half of those tested for torque, specific torque, bhp and specific horsepower; its engine/muffler combination is, however, the second lightest, so it's fourth in the torque-to-weight category.

Idle: very good at 2,450rpm; **midrange:** excellent throttle-up; **best props:** APC 13x7, APC 11x11, APC 12x7. **Price $109.99**

MDS .58 FS Pro

A relatively small, light engine, the MDS .58 is the only one tested with a displacement of less than .60ci; it's also the only one equipped with a smallish—¼x28-inch—crankshaft nose thread; twin ball bearings support the crankshaft, and it comes with a good-quality fuel-metering carb.

Performance comparison: From the aspect of torque and power production, the MDS is handicapped by a relatively small displacement (.58ci), and it has third smallest carburetor-choke bore, so it finished last in these four categories. Because it is the lightest engine/muffler combination tested, it ranks better in torque to weight and horsepower to weight, finishing second and third, respectively, in these areas.

Idle: excellent at 2,400rpm; **midrange:** crisp, smooth transition to wide-open throttle; **best props:** APC 13x7, APC 12x8, APC 11x10. **Price $89.95**

Megatech M-61

The brass cylinder-sleeve is a casting that includes all of the ports; chrome plating has been applied in a conventional manner; the engine has twin ball bearings and a fuel-metering carburetor that is similar to the O.S. type 7H but doesn't have the mid-range adjustment.

Performance comparison. With the third-largest carburetor-choke bore, the Megatech M-61 ranks fourth in bhp and specific horsepower; it ranks sixth in torque and fifth in specific torque. It is the heaviest engine tested and finished last in torque to weight and horsepower to weight.

Idle: excellent at 2,400rpm; midrange: slightly rich; hesitant acceleration to wide-open throttle; **best props:** APC 13x7, APC 11x10, APC 12x8. **Price $99.99**

O.S. Max FX-61

A beautifully built ABN engine with a ball-bearing-supported crankshaft and remotely mounted primary needle valve.

Performance comparison. With the fifth smallest carburetor-choke bore, the O.S. Max FX-61 was eighth in torque and tied for seventh in horsepower. The fifth lightest engine, it ranks seventh in torque to weight, and seventh in horsepower to weight. It's the second quietest engine/muffler combination tested.

Idle: excellent at 2,400rpm with its twin-needle, fuel-metering carburetor; **mid-range:** slightly hesitant (rich) throttle-up; **best props:** APC 11x10, APC 11x11, APC 12x7. **Price $149.99**

O.S. .65 LA

Highlighted by flawless castings and precision machine-tool operations, this ABN engine has a cylinder sleeve made of thin-wall (0.057-inch) seamless brass tube; it has a bronze plain bearing for crankshaft support; an air-bleed carb is standard equipment.

Performance comparison:. With the smallest carburetor-choke bore of the group tested, the O.S. .65 LA also has the largest cylinder displacement (.65); it ranks sixth in bhp and ninth in specific horsepower. Torque and specific torque were similarly low—possibly an indication of a breathing problem. Because it's the sixth lightest engine tested, the O.S. performs reasonably well in torque to weight and horsepower to weight. It's the quietest engine/muffler combo tested.

Idle: excellent at 2,400rpm; **midrange:** excellent, crisp throttle-up; **best props:** APC 13x7, APC 12x8, APC 11x11. **Price $104.99**

Thunder Tiger GP-61 ABC

Great castings and machine-tool operations; an ABN piston and cylinder-sleeve set; a traditional bronze bushing for crankshaft support; an elementary air-bleed type carburetor with an angled-back needle-valve assembly (a welcome safety feature).

Performance comparison. This engine tied with the O.S. .65 LA for having the smallest carb-choke bore among the engines tested. This probably explains why its bhp and specific horsepower rank in the lower half. With its ability to breathe somewhat restricted, the GP-61 still ranks a credible fourth in torque and specific torque. As the fourth heaviest engine/muffler combo, it ranks sixth in torque to weight and eighth in horsepower to weight.

Idle: very good at 2,450rpm; **midrange:** excellent throttle-up; **best props:** APC 12.5x9, APC 13x7, APC 12x8. **Price $84.99**

Thunder Tiger Pro .61 BB ABC

Thunder Tiger mass-produces high-quality engines that have fine castings and accurate machine work, and the Pro .61 displays these throughout, including in its ABN piston and cylinder-sleeve assembly. The crankshaft is supported by two ball bearings; the carburetor is a 2-needle fuel-metering type with a sweptback primary needle valve and a healthy choke diameter of 0.357 inch.

Performance comparison. This engine tied for the fourth largest carburetor-choke bore. It is third best in torque and specific torque; this confirms its ability to breathe efficiently and to turn high-load props at relatively high speeds. Its bhp and specific horsepower rank in the middle of the pack. The engine/muffler combination is the third heaviest and puts it at the bottom of the pack for torque to weight and horsepower to weight rankings.

Idle: fair at 2,550rpm; **midrange:** sputtering (rich) acceleration to wide-open throttle; **best props:** APC 12.5x9, APC 13x7, APC 12x8. **Price $99.99**

Tower .61 BB ABC

A twin-ball-bearing-supported crankshaft and fuel-metering carburetor accompany a true ABN piston and cylinder sleeve; a remotely located primary needle-valve enhances the engine's safety rating.

Performance comparison. Ranking first in bhp and specific horsepower, this engine has a carburetor-choke bore that tied for fourth largest. As the fourth lightest engine, it ranks first in the horsepower-to-weight category and has a second-best ranking in torque and specific torque. The Tower .61 can turn large propellers faster than all except one other engine tested. It ranks third in torque to weight.

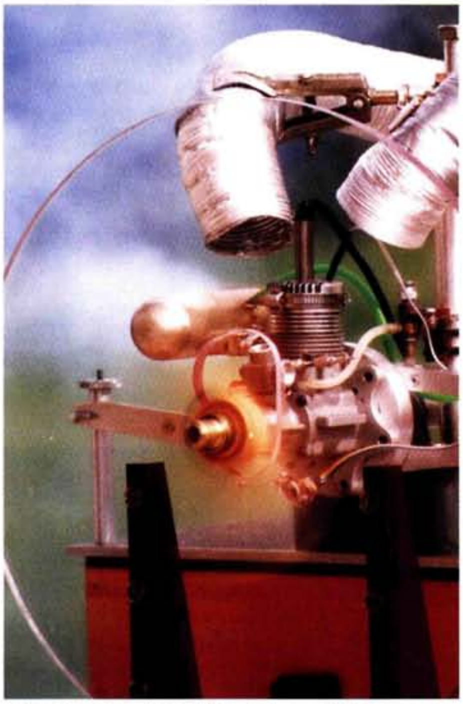
Idle: good at 2,500rpm; **midrange:** very good throttle-up (slight hesitation); **best props:** APC 12.5x9, APC 13x7, APC 11x10, APC 12x8. **Price $89.99**

What to compare

Don't pay much attention to the peak brake horsepower (bhp) produced by these engines; you'll notice that the highest horsepower levels are achieved with small (low-load) propellers (APC 11x6, etc.), none of which are used with typical .60 sport models. High-horsepower, small-prop applications are the domain of racers with more sophisticated (and expensive) engines that are used in low-drag, high-speed airframes.

Torque is a more useful performance parameter for sport engines. Torque determines the propeller size your engine is able to turn within its usable rpm range. If you're interested in the true horsepower story, take the rpm value for each given prop on the "Comparison of rpm with various APC propellers" table, and look up that value on the engine's power graph; do you see how much less power is generated at that rpm than is produced at the peak horsepower point? Now check the torque value for the same prop and rpm; you'll notice that for sport-plane props, the rpm they turn is closer to peak torque than to peak bhp—a good thing. Example: engine: O.S. .61 FX; propeller: APC 13x7; prop rpm: 9,900; torque: 99.8 oz.-in. @ 9,900rpm; horsepower: 1.02bhp @ 9,900rpm.

For any sport engine, it's practical to look at peak torque per dollar invested (street price). For example, if the engine produces 100 oz.-in. of torque and costs $100, it generates 1 oz.-in. for each dollar spent.



Dynamometer "load beams" are pitchless propellers that allow uniform increases in rpm from one size to the next; the author's beams are in ¼-inch increments from 2 to 10 inches.

None of the engines featured in this article have exactly the same displacement (they range from .58 to .65ci), so it's useful to know their "specific torque" (oz.-in./ci) to "neutralize" this discrepancy. Example: if a .58ci engine produces 100 oz.-in. of torque, its specific torque is 172 oz.-in./ci (100/.58). If a .65 engine also produces 100 oz.-in. of torque, its specific torque is 154 oz.-in./ci (154/.65).

Since the weights of the engine/muffler combinations also vary, it's useful to compare them in terms of torque to weight (oz.-in./lb.). Example: if an engine produces 100 oz.-in. of torque and weighs 1.34 pounds, its torque-to-weight ratio is 74.6 oz.-in/lb. (100/1.34). If a 1.74-pound engine also produces 100 oz.-in. of torque, its torque-to-weight ratio is 57.5 oz.-in./lb. (100/1.74).

If you're interested in neutralizing the cubic-inch-displacement discrepancy for the bhp of the shootout engines, you can use specific horsepower (bhp/ci); horsepower to weight (bhp/lb.) is also useful.

Finally, compare the noise (decibel levels) of the engines. This will tell you how well your new mill will be accepted at the flying field. Remember that every 3-decibel (dB) increase or decrease represents a doubling or halving of the perceived noise. All of this information is listed in the "Performance comparisons at a glance" table. Have fun comparing!

Comparison of rpm with various APC propellers

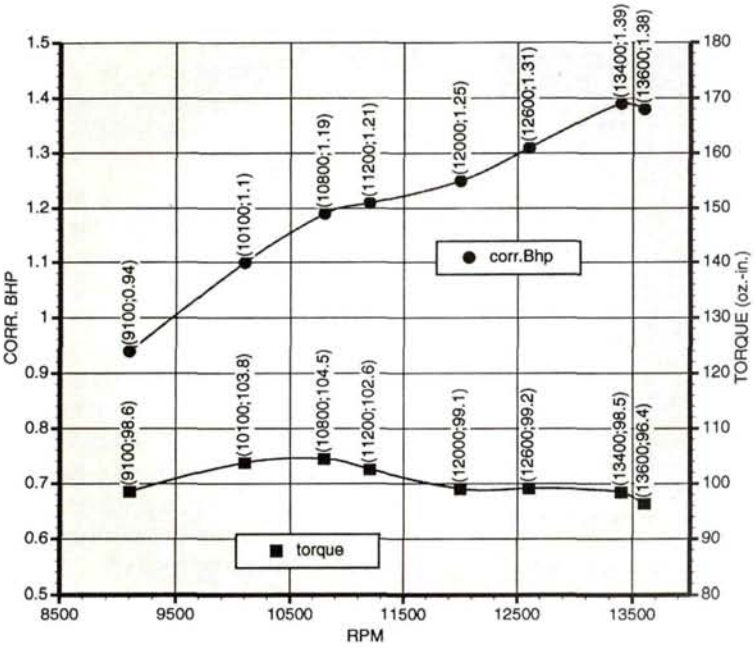
APC propeller	O.S. Max FX-61	O.S. .65 LA	Magnum XL61A	Thunder Tiger GP-61	Tower .61	Thunder Tiger Pro .61	Irvine .61	Fox Eagle .61	Megatech M-61	MDS .58
11x6	13,150	13,350	13,250	13,150	14,450	13,450	13,600	13,850	13,500	12,950
11x7	13,000	13,250	13,000	13,050	14,150	13,300	13,400	13,550	13,300	12,650
11x8	12,250	12,350	12,350	12,350	12,850	12,450	12,600	12,900	12,600	11,800
12x6	11,750	11,750	11,750	11,925	12,150	12,050	12,000	12,300	12,100	11,200
12x7	10,950	11,000	10,950	11,150	11,250	11,200	11,200	11,550	11,200	10,450
11x11	10,450	10,550	10,500	10,650	10,950	10,750	10,800	11,150	10,650	10,100
12x8	10,300	10,150	10,150	10,350	10,800	10,450	10,500	10,950	10,500	9,700
11x10	10,000	10,350	9,750	10,250	10,650	10,650	10,100	10,850	10,200	9,250
13x7	9,900	9,950	9,750	10,150	10,450	10,250	10,100	10,650	10,100	9,250
12.5x9	9,250	9,450	8,950	9,450	9,750	9,500	9,100	9,850	9,400	8,550

Irvine .61 MK II ABC

General impressions. You would have to be blind not to notice the Irvine .61 crankcase's glossy, baked-on maroon finish—beautiful! Although I'm not familiar with the factory process used to apply this great-looking, fuelproof paint, it appears to be a powder-coating technique because the interior bypass channels are also colored; all the machining was done after the coating had been applied.

• **Performance.** Break-in, propeller rpm determination and dynamometer tests were all run using Sig 10-percent-nitromethane fuel containing 20 percent lubricant (the standard blend for ABC-type engines equipped with ball-bearing crankshaft support). An APC, 11x6, 2-blade propeller and a Thunderbolt R/C long-reach glow plug were used.

For break-in, the Irvine .61 MK II was run for 20 minutes. It started, needled and maintained a steady operation throughout; at the end of this period, it peaked at 13,600rpm.



Irvine .61

Temp. 79 deg. F

Bar. pres. 29.30 in. Hg

Wet-bulb temp. 67 deg. F

Corr. fact. 1.06

Dynamometer-generated torque and horsepower curves indicate

- torque peak—104.5 oz.-in. @ 10,800rpm (rank: 7th)
- bhp peak—1.39 @ 13,400rpm (rank: 3rd)
- specific torque (oz.-in./ci)—171 (rank: 6th)
- specific horsepower (bhp/ci)—2.28 (rank: 3rd)
- torque-to-weight ratio (oz.-in./lb.) —62.2 (rank: 9th);
- horsepower to weight (bhp/lb.) —0.83 (rank: 6th).

SPECIFICATIONS	O.S. Max FX-61	O.S . 65 LA	Magnum XL61A	Thunder Tiger GP-61	Tower .61
Bore-stroke (mm)	24x22	24x24	24x22	24.2x23	24x22
Displacement	0.607ci	0.662ci	0.607ci	0.646ci	0.607ci
Engine & muffler weight	24.3 oz.	24 oz.	21.5 oz.	21.46 oz.	23.45 oz.
Muffler type	E-4010 Expansion	E-4010 Expansion	Expansion	9225 Expansion	TOWG 4727 Expansion
Carb. type	O.S. 60C Fuel metering	O.S. 60J Air bleed	Fuel metering	9241N Air-bleed	TOWG 4106 Fuel metering
Carb. bore (mm/in.)	8.5/0.334	8/0.315	9.76/0.385	8/0.315	9.07/0.357
Crank nose thread	UNF 5⁄16-24	UNF 5⁄16-24	8mm	UNF 5⁄16-24	UNF 5⁄16-24
Fuel: all running (% nitro/oil)	10/20%	10/22%	10/20%	10/22%	10/20%
Glow plug	O.S. no. 8 (long)	O.S. no. 8 (long)	Thunderbolt R/C (long)	None supplied; O.S. no. 8 (L) used	None supplied; O.S. no. 8 (L) us
Warranty (limited)	2-yr.	2-yr.	2-yr.	3-yr.	2-yr.

Performance comparisons at a glance

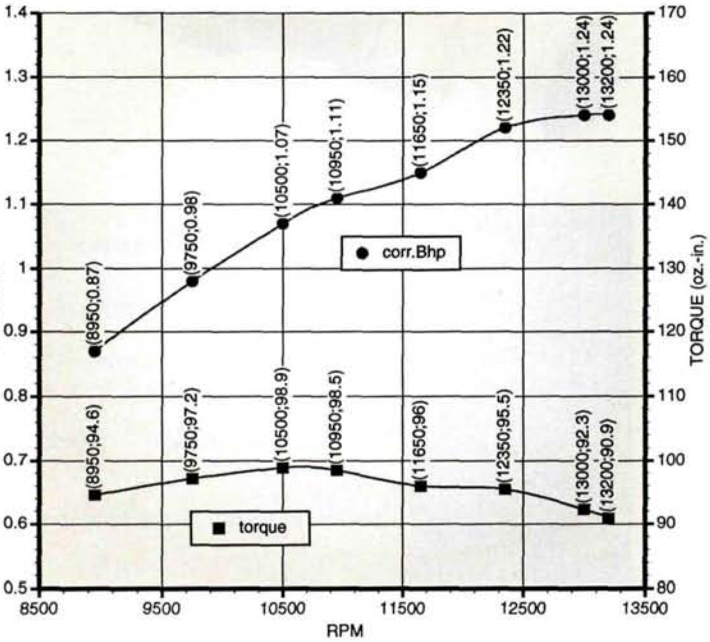
Engine	Torque per $	Street price	Torque	Specific torque	Torque/lb.	Bhp	Specific bhp	Bhp/lb.	Sound level (
Thunder Tiger GP-61	1.26	$84.99	106.7	175	69.7	1.24	2.03	0.81	95.0
Tower .61	1.25	$89.99	112.7	185	76.7	1.59	2.61	1.08	98.5
Thunder Tiger Pro .61	1.07	$99.99	107.2	176	64.2	1.33	2.18	0.80	98.0
Fox Eagle .61	1.05	$110.00	115.6	190	82.0	1.41	2.31	1.0	103.0
Megatech M-61	1.05	$99.99	105.1	172	60.4	1.34	2.20	0.77	99.0
MDS .58	1.03	$89.95	92.6	160	77.2	1.16	2.00	0.97	96.0
O.S. .65 LA	1.00	$104.99	105.6	162	70.4	1.31	2.02	0.87	92.0
Magnum XL61A	0.90	$109.99	98.9	162	73.8	1.24	2.03	0.93	98.0
O.S. FX-61	0.68	$149.99	101.3	166	66.6	1.24	2.13	0.82	94.0
Irvine .61	0.50	$206.99	104.5	171	62.2	1.39	2.28	0.83	102.0

Magnum XL61A BB FSR

General impressions. This engine has several desirable features, including: a ball-bearing-supported crankshaft, a fuel-metering carburetor and state-of-the-art piston/cylinder-sleeve materials. Some machine-tool operations are rough, as is the engine's general appearance.

• **Performance.** Engine break-in, propeller rpm determination and dynamometer testing were all run using Sig 10-percent-nitromethane fuel containing 20 percent lubricant (my standard blend for ABC-type engines equipped with ball bearings for crankshaft support). I used an APC, 11x6, 2-blade propeller and a Thunderbolt R/C long-reach glow plug.

For break-in, I ran the Magnum XL61A for a total of 20 minutes; afterward, the engine peaked at a smooth and steady 13,250rpm.



Magnum .61 XL

Temp. 71 deg. F

Bar. pres. 29.57 in. Hg

Wet-bulb temp. 62 deg. F

Corr. fact. 1.04

Dynamometer-generated performance curves indicate:

- torque peak—98.9 oz.-in. @ 10,500rpm (rank: 9th)
- corrected bhp peak—1.24 @ 13,000rpm (rank: tied for 7th)
- specific torque (oz.-in./ci)—162 (rank: tied for 8th)
- specific horsepower (bhp/ci)—2.03 (rank: tied for 6th)
- power-to-weight ratio (bhp/lb.)—0.92 (rank: 4th)
- torque to weight (oz.-in./lb.)—73.8 (rank: 4th)

Thunder Tiger Pro .61	Irvine .61 MK II ABC	Fox Eagle .61 ABC	Megatech M-61	MDS .58 FS Pro
23.5x23	24x22	23x23.8	23x23.8	23.7x21.6
0.609ci	0.607ci	0.604ci	0.604ci	0.58ci
26.75 oz.	26.81 oz.	22.5 oz.	27.78 oz.	19.21 oz.
9295 Expansion	S-61-2340 Expansion	90262 Expansion	Expansion	04600300 Expansion
9240N Fuel metering	CJ-1900 Fuel metering	27050B E-Z Air bleed	Fuel metering	C-2 Fuel metering
9.07/0.357	9.42/0.371	8.43/0.332	9.4/0.370	8.2/0.322
UNF 5⁄16-24	UNF 5⁄16-24	UNF 5⁄16-24	UNF 5⁄16-24	UNF 5⁄16-28
10/20%	10/ 20%	5/22%	10/ 20%	10/20%
None supplied; O.S. no. 8 (L) used	Thunderbolt R/C (long)	Fox idle bar O.S. no. 8 (L) used	None supplied; O.S. no. 8 (L) used	MDS (long)
3-yr.	2-yr.	2-yr.	2-yr.	3-yr.

Engine performance was determined by measuring torque and rpm at various load points while operating the engine at wide-open throttle. The author's dynamometer measures torque while a precision tachometer measures rpm; by running the engine many times with a progressively smaller load, he acquired data that allows him to plot a graph of the engine's torque and rpm. Brake horsepower was calculated from the torque/rpm data, and it's also graphed with respect to rpm.

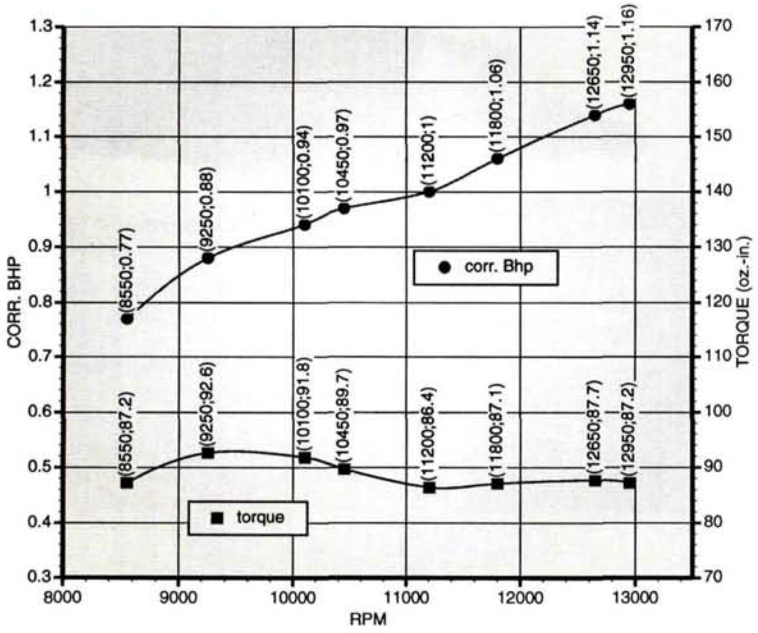
Sig Champion Fuel was used for break-in and for many flight propeller-rpm and dynamometer tests.

MDS .58 FS Pro

General impressions. A relatively small, light engine with delicate features; it's the only one of the 10 engines tested to be equipped with a ¼x28 crankshaft nose thread and a thin-wall (0.066-inch) cylinder sleeve.

• **Performance.** For break-in, propeller rpm determination and dynamometer testing, I used Sig 10-percent-nitromethane fuel containing 20 percent lubricant (the standard blend for ABC-type engines equipped with a ball-bearing crankshaft support). I also used an APC, 11x6, 2-blade propeller and an MDS long-reach glow plug.

For break-in, I ran the MDS .58 for 30 minutes; break-in was uneventful, as the engine started, needled and maintained a steady operation throughout. At the end of this period, the engine peaked at 12,950rpm.



MDS .58 FS pro

Temp. 65 deg. F

Bar. pres. 29.41 in. Hg

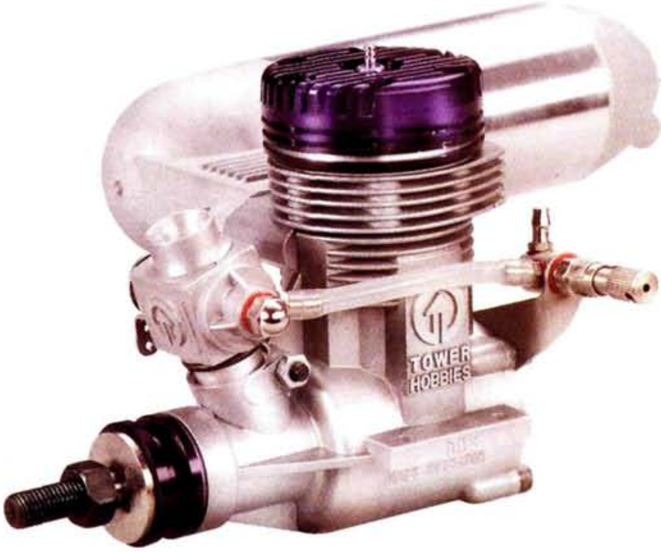
Wet-bulb temp. 59 deg. F

Corr. fact. -1.04

Dynamometer-generated torque and horsepower curves indicate:

- **torque peak**—92.6 oz.-in. @ 9,250rpm (rank: 10th)
- **bhp peak**—1.16 @ 12,950rpm (rank: 10th)
- **specific torque (oz.-in./ci)**—160 (rank:10th)
- **specific horsepower (bhp/ci)**—2 (rank: 10th)
- **torque to weight ratio (oz.-in./lb.)**—77.2 (rank: 2nd)
- **power to weight (bhp/lb.)**—0.97 (rank: 3rd)

Tower .61 BB ABC



General impressions. If the Tower .61 BB ABC looks familiar to old-timers, it should; it's the latest variation on the Italian Super Tiger S.61 that began in 1982 as a lapped ABC engine. This latest Tower Tiger is made in China with much of the original ST tooling.

My initial inspection revealed a roughness when I turned the engine over. After removing the backplate, I discovered grinding compound in the crankcase and the rear crankshaft ball bearing, so I had to take the engine apart and clean it.

• **Performance.** Using Sig 10-percent-nitromethane fuel containing 20 percent lubricant (my standard blend for ABC-type engines equipped with ball-bearing crankshaft support), I broke the engine in for 28 minutes while also determining propeller rpm and doing the dynamometer tests. My prop was an APC, 11x6, 2-blade, and I used an O.S. no. 8 long-reach glow plug.

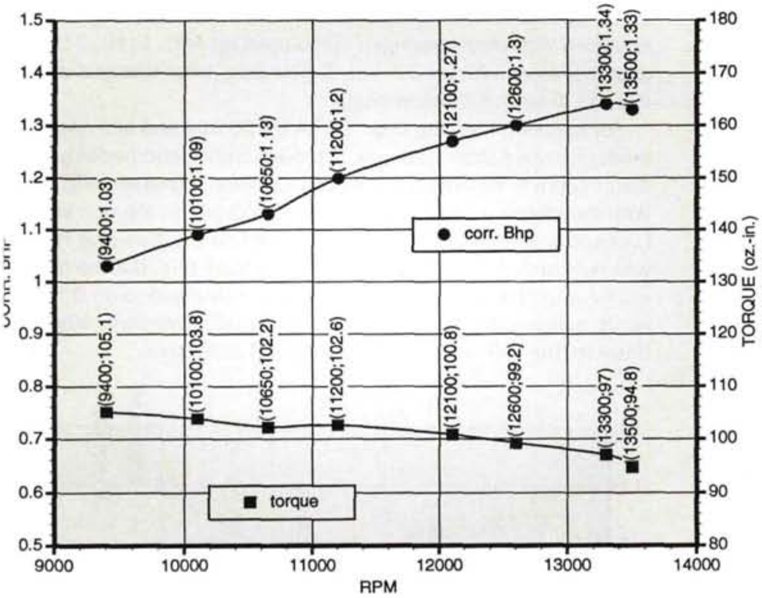
Initially, the engine was very difficult to turn over because of a tight piston/cylinder-sleeve pinch fit; considered normal, this condition can be overcome by briefly heating the cylinder/cylinder-head area with a heat gun or a hair dryer to expand the sleeve away from the piston and allow the mill to be started normally. After break-in, the engine peaked at a strong 14,250rpm.

Megatech M-61

General impressions. The chrome-plated brass cylinder-sleeve is cast with the ports in place (a new technology emerging?); the carburetor is very similar to the O.S. type 7H (a fuel-metering type) but doesn't have the midrange adjustment. My initial inspection revealed loose cylinder-head and backplate screws. Including the muffler (7.5 ounces), the M-61 is the heaviest engine evaluated.

• **Performance.** I used Sig 10-percent-nitromethane fuel containing 20 percent lubricant—the standard blend for ABC-type engines with ball-bearing crankshaft support—for break-in, propeller rpm determination and dynamometer testing. I also used an APC, 11x6, 2-blade propeller and an O.S. no. 8 long-reach glow plug.

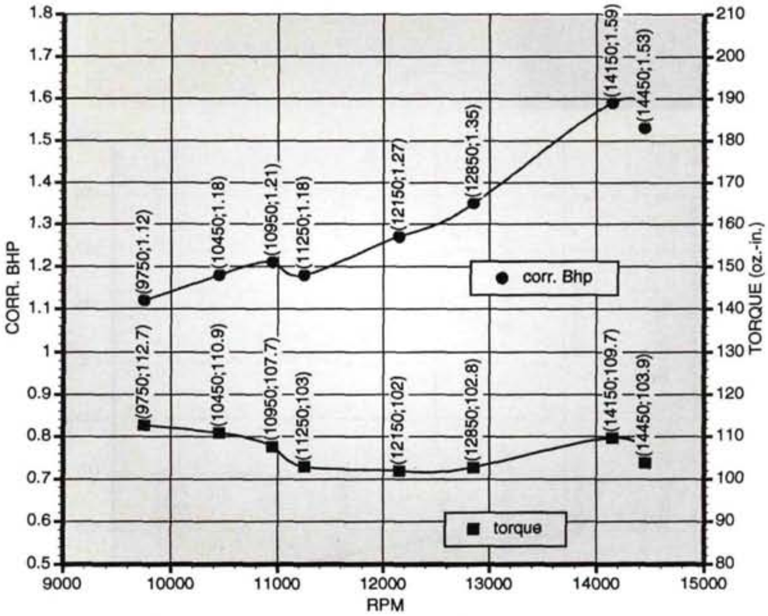
For break-in, I ran the Megatech M-61 for 20 minutes; the first two runs resulted in burned-out glow plugs. I added a 0.010-inch-thick aluminum head shim, which improved the situation. The rest of the break-in was uneventful: the engine started, needled and maintained a steady, if somewhat rough, operation. At the end of break-in, the M-61 peaked at 13,200rpm. A parting thought: the M-61 may still be over-compressed; this would account for its roughness at high speeds.



Megatech M-61	**Dynamometer-generated torque and horsepower curves indicate:**
Temp. 72 deg. F Bar. pres. 29.30 in. Hg Wet-bulb temp. 62 deg. F Corr. fact. 1.05	· torque peak—105.1 oz.-in. @ 9,400rpm (rank: 6th) · bhp peak—1.34 @ 13,300rpm (rank: 4th) · specific torque (oz.-in./ci)—172 (rank: 5th) · specific horsepower (bhp/ci)—2.20 (rank: 4th) · torque to weight ratio (oz.-in./lb.)—60.4 (rank: 10th) · horsepower to weight (bhp/lb.)—0.77 (rank: 10th)

Tower .61 ABC	**Dynamometer-generated torque and horsepower curves indicate:**
Temp. 63 deg. F Bar. pres. 29.46 in. Hg Wet-bulb temp. 58 deg. F Corr. fact. 1.03	· torque peak—112.7 oz.-in. @ 9,750rpm (rank: 2nd) · bhp peak—1.59 @ 14,150rpm (rank: 1st) · specific torque (oz.-in./ci)—185 (rank: 2nd) · specific horsepower (bhp/ci)—2.61 (rank: 1st) · torque to weight ratio (oz.-in./lb.)—76.7 (rank: 3rd); · horsepower to weight (bhp/lb.)—1.08 (rank: 1st)

The torque peak for the Tower .61 is interesting: there are actually two—one between 9,750 and 12,150rpm and another between 12,150 and 14,450rpm. This anomaly produces the stepped bhp curve shown on the graph. Testing error was ruled out when similar data were collected during a dyno rerun. Engines occasionally display strange performance characteristics that seem to defy logic; in this case, I suspect a serendipitous supercharging effect from the muffler/manifold and cooperative cylinder-port timing.



O.S. Max FX-61

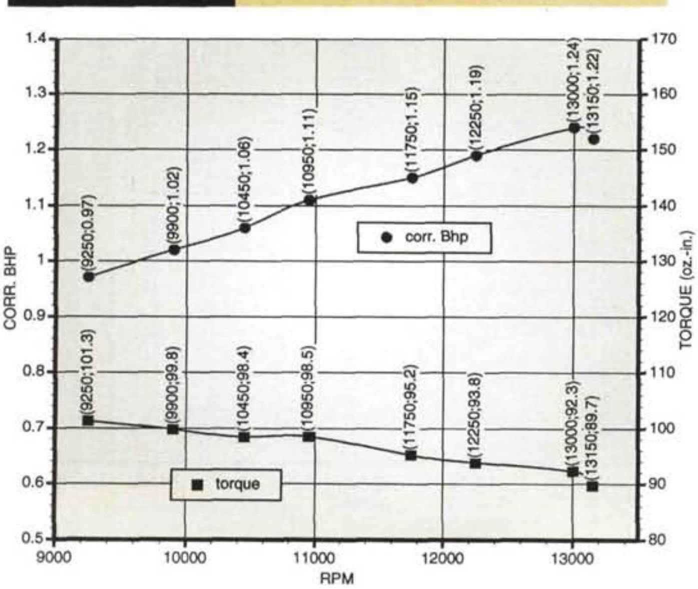
General impressions. Beautiful casting and machine work throughout—O.S. trademarks. The hemi-head combustion-chamber components are not machined but are bead-blast finished—an unusual but time-saving procedure.

The engine's drop-in cylinder-sleeve shows a dedication to excellence that's rarely duplicated in the miniature-engine industry. Technical highlights include: precisely machined ports, smooth nickel-plating and flawless taper honing. The impressive unit should be mounted on a display stand for all engine lovers to admire.

• **Performance.** For break-in, propeller-rpm determination and dynamometer testing, I used Sig 10-percent-nitromethane fuel containing 20 percent lubricant (my standard blend for ball-bearing-equipped ABN engines). For low-load break-in, I used an APC, 11x6, 2-blade propeller, and for all runs, I chose an O.S. no. 8 long-reach glow plug.

I ran the O.S. Max FX-61 for 20 minutes of break-in; at the end of this, it held a peaked setting of 13,150rpm.

O.S. Max FX .61	**Dynamometer-generated torque and horsepower curves indicate:**
Temp. 70 deg. F Bar. pres. 29.39 in. Hg Wet-bulb temp. 60 deg. F Corr. fact. 1.04	· **torque peak**—101.3 oz.-in. @ 9,250rpm (rank: 8th) · **bhp peak**—1.24 @ 13,000rpm (rank: tied for 7th) · **specific torque (oz.-in./ci)**—166 (rank: 7th) · **specific horsepower (bhp/ci)**—2.03 (rank: tied for 6th); · **torque-to-weight ratio (oz.-in./lb.)**—66.6 (rank: 7th) · **power to weight (bhp/lb.)**—0.82 (rank: 7th)

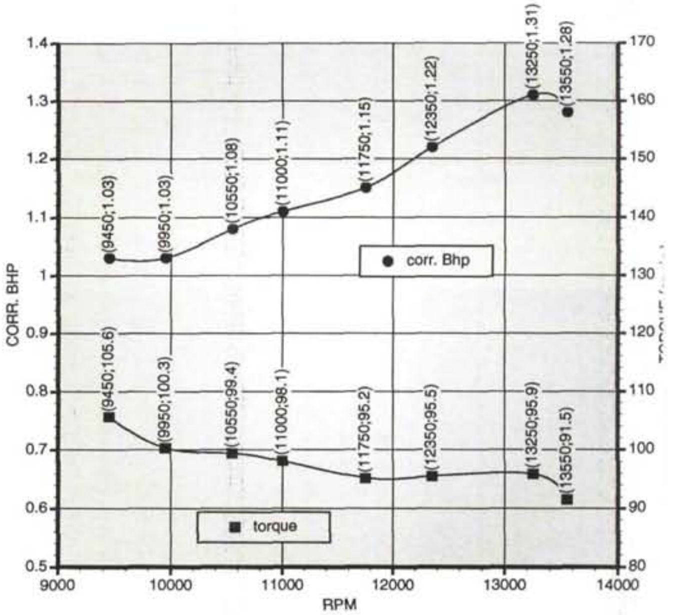


O.S. .65 LA

General impressions. A powder-coated external finish; a remote, backplate-mounted needle-valve assembly; an inexpensive air-bleed carburetor; a cylinder sleeve made of seamless brass tube; a composite-plastic backplate; a bronze bushing for crankshaft support; flawless castings and precision machine-tool operations are standard for O.S. engines.

• **Performance.**
Engine break-in, propeller rpm determination and dynamometer testing were all done using Sig 10-percent-nitromethane fuel with 22 percent lubricant (my standard blend for ABC-type engines equipped with plain bearings). I also used an APC, 11x6, 2-blade propeller along with an O.S. no. 3 glow plug (later changed to an O.S. no. 8 long-reach glow plug).

For break-in, I ran the O.S. .65 LA for 20 minutes and noted a moderate crankshaft-seal leak. Although high-speed performance didn't seem to be affected, fuel consumption increased slightly. With the engine almost peaked (about 300rpm on the rich side), I noticed that it dropped about 500rpm when the glow-plug heat was removed. A number of factors may cause this, but the quickest fix is to change to a hotter glow plug. I changed to an O.S. no. 8; subsequent runs showed a marked improvement. After break-in, the .65 held a steady, peaked 13,350rpm.



O.S. .65 LA	**Dynamometer-generated torque and horsepower curves indicate:**
Temp. 75 deg. F Bar. pres. 29.47 in. Hg Wet-bulb temp. 62 deg. F Corr. fact. 1.04	· **torque peak**—105.6 oz.-in. @ 9,450rpm (rank: 5th) · **bhp peak**—1.31 @ 13,250rpm (rank: 6th) · **specific torque (oz.-in./ci)**—162 (rank: tied for 8th) · **specific horsepower (bhp/ci)**—2.02 (rank: 9th) · **torque-to-weight ratio (oz.-in./lb.)**—70.4 (rank: 5th) · **power to weight (bhp/lb.)**—0.87 (rank: 5th)

Thunder Tiger Pro .61 BB ABC

General impressions. My first reaction to all Thunder Tiger engines is always admiration because of their spectacular castings and machine-tool work.

• **Performance.** I used Sig 10-percent-nitromethane fuel containing 20-percent lubricant—my standard blend for ABC-type engines equipped with ball-bearing crankshaft support—for engine break-in, propeller-rpm determination and dynamometer testing. I also used an APC, 11x6, 2-blade propeller and a Fox R/C long-reach glow plug.

For break-in, I ran the Thunder Tiger Pro .61 for 20 minutes; initially, it quit when I removed the glow-plug heat, so I changed to a hotter O.S. no. 8 plug, which improved the situation. Also during the first run, the front bearing leaked fuel; since little can be done to correct this—other than to replace the crankcase—I tolerated it. If my tight testing schedule had permitted, I would have returned the engine for a replacement.

Early break-in runs produced two burned-out plug elements; this suggested that the engine's compression ratio was too high, so I removed the cylinder head and inserted an additional 0.010-inch-thick aluminum shim (gasket). The engine then ran more smoothly and didn't trash any more plugs. I had difficulty obtaining a reliable idle below 2,550rpm; this may be the result of the reduction in fuel draw caused by the pressure/vacuum leak at the crankshaft seal. At the end of break-in, the Pro .61 ran steadily at 13,450rpm.

Thunder Tiger Pro .61

Temp. 68 deg. F

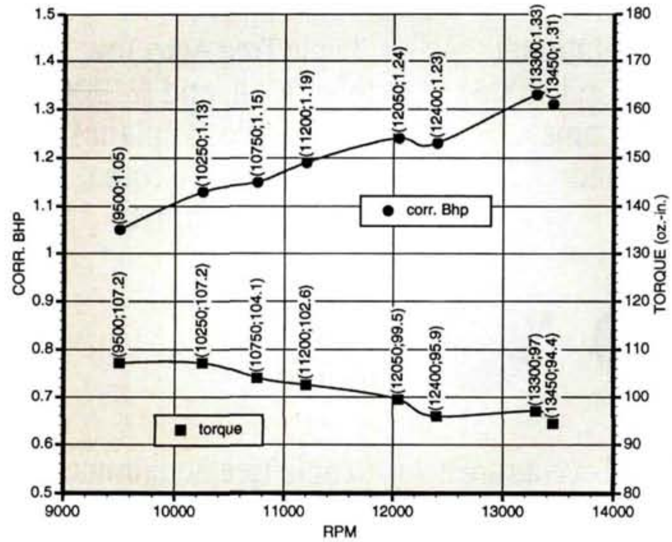
Bar. pres. 29.43 in. Hg

Wet-bulb temp. 59 deg.F

Corr. fact. 1.04

Dynamometer-generated torque and horsepower curves indicate:

- torque peak—107.2 oz.-in. @ 9,500rpm (rank: 3rd)
- bhp peak—1.33 @ 13,300rpm (rank: 5th)
- specific torque (oz.-in./ci)—176 (rank: 3rd)
- specific horsepower (bhp/ci)—2.18 (rank: 5th)
- torque-to-weight ratio (oz.-in./lb.)—64.2 (rank: 8th)
- power to weight (Bhp/lb.)—0.80 (rank: 9th)

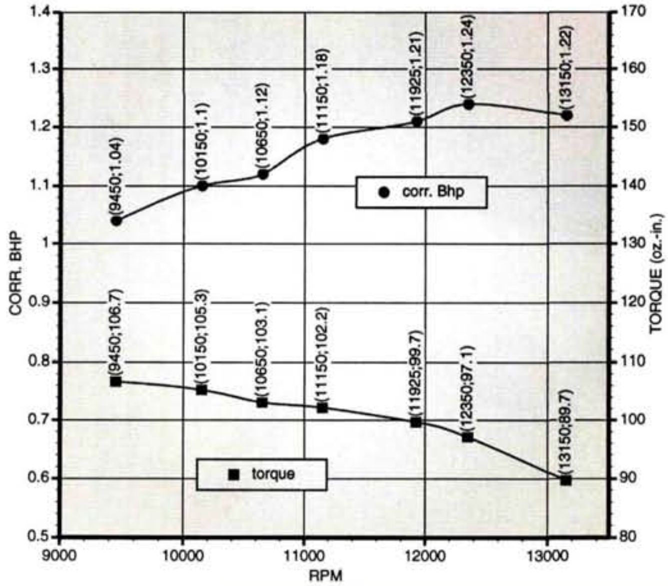


Thunder Tiger GP-61 ABC

General impressions. Beautiful castings, lathe turning, milling, grinding and honing operations; a traditional bronze bushing supports the crankshaft. This engine is meticulously produced.

• **Performance.** For break-in, propeller-rpm determination and dynamometer testing, the Thunder Tiger GP-61 was run with Sig 10-percent-nitromethane fuel containing 22-percent lubricant (my standard blend for plain-bearing-equipped, ABC-type engines). I used an APC, 11x6, 2-blade propeller for low-load break-in and installed an O.S. no. 8 long-reach glow plug for all runs.

For break-in, I ran the GP-61 uneventfully for 22 minutes; afterward, the engine peaked at a smooth 13,150rpm.



Thunder Tiger GP- 61

Temp. 67 deg. F

Bar. pres. 29.40 in. Hg

Wet-bulb temp. 57 deg. F

Corr. fact. 1.04

Dynamometer-generated torque and horsepower curves indicate:

- torque peak—106.7 oz.-in. @ 9,450rpm (rank: 4th)
- corrected bhp peak—1.24 @ 12,350rpm (rank: tied for 7th)
- specific torque (oz.-in./ci)—175 (rank: 4th)
- specific horsepower (bhp/ci)—2.03 (rank: tied for 6th)
- torque-to-weight ratio (oz.-in./lb.)—69.7(rank: 6th)
- power to weight (bhp/lb.)—0.81 (rank: 8th)

When I had a technical difficulty while testing this engine, I was pleased by the prompt and courteous attention of the Ace Hobby representatives.

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HOT ACTION

State-of-the-art sailplanes at Soar Utah

by Richard Loud

Tom Henscheid flew his EPP Beech Staggerwing, perhaps the only EPP biplane kit produced for the slope. This unique kit is available from Mountain Toys.

The InterMountain Silent Flyers (IMSF) host Soar Utah every two years to show off some of the country's most spectacular slope-soaring sites. The main site is Point of the Mountain (POTM), just south of Salt Lake City, but the typical agenda also includes trips to Antelope Island in the middle of the Great Salt Lake and Francis Peak in the Wasatch Mountains.

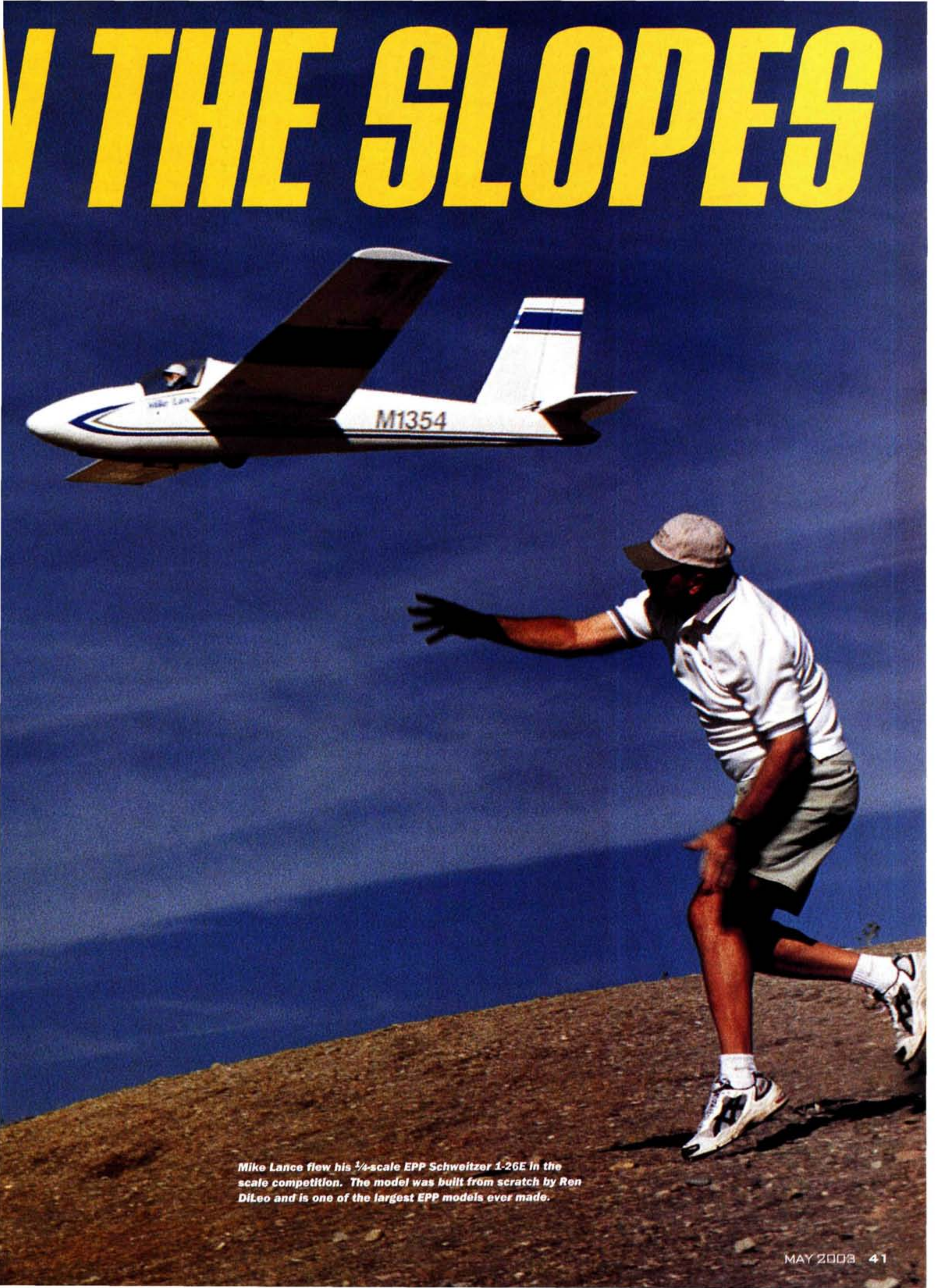
Soar Utah officially kicked off on August 31 with more than 100 pilots registering on Friday evening; flying was scheduled for Saturday and Sunday at POTM. By the time I arrived on Thursday afternoon, however, a core group of serious "slope heads" was already camped on the hillside, and planes filled the air.

Pulling into the parking area, we were immediately greeted by an immaculate and very large A-10, scratch-built by Dave Wenzlick of Mesa, AZ. Yes, this is what Soar Utah is about: big, cool, state-of-the-art sailplanes. I could hardly wait to see the big Warthog fly! I couldn't help but wonder what other treats we were in for.

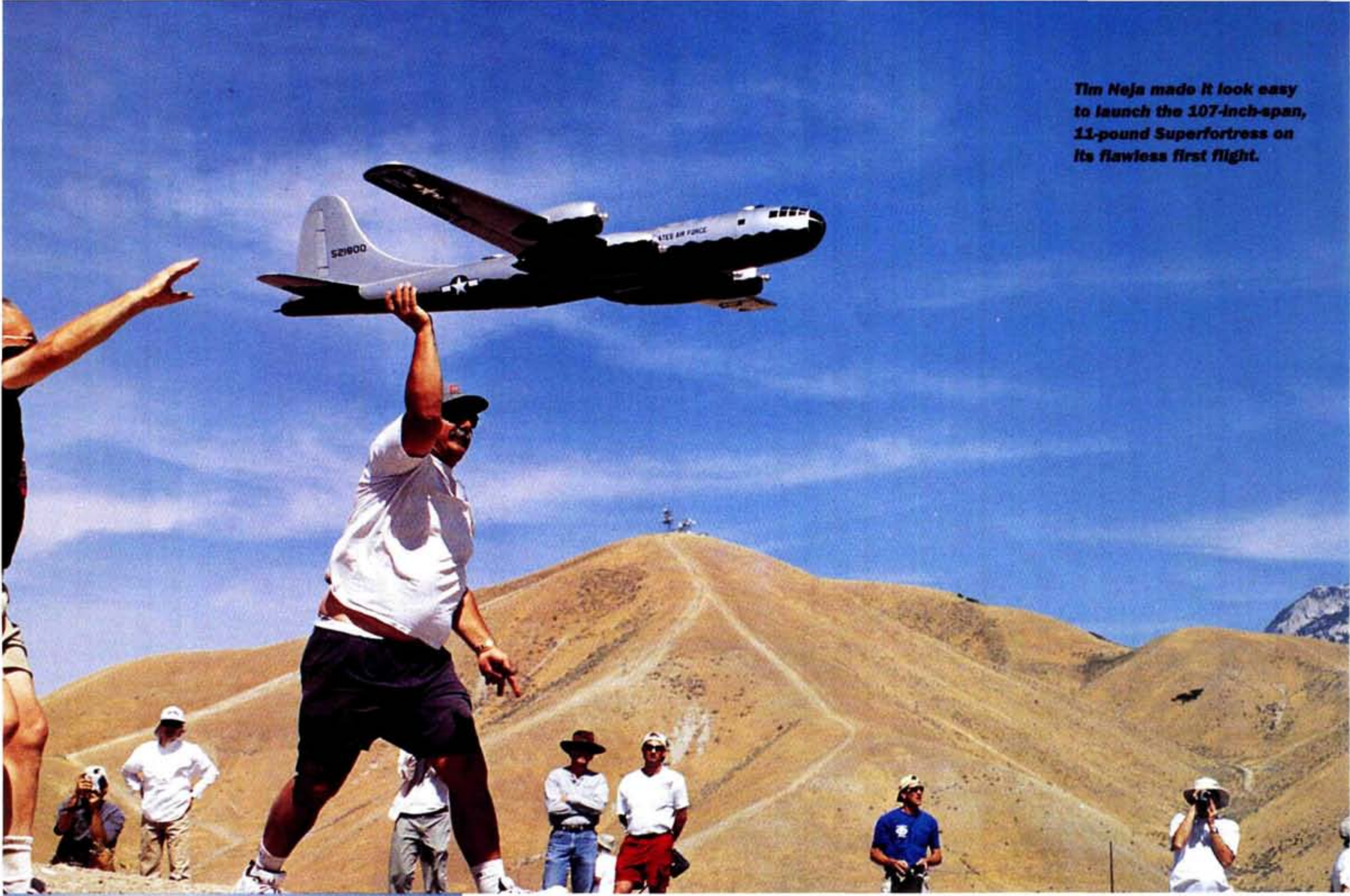
The pit area was full of some of the world's finest examples of RC sailplane craftsmanship and ingenuity.

PHOTOS BY RICHARD LOUD

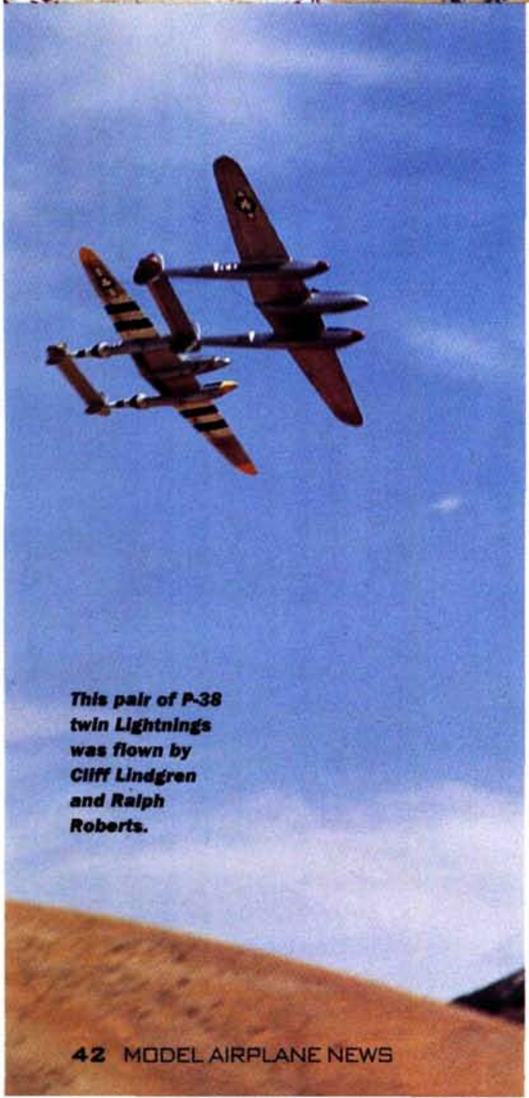
N THE SLOPES



Mike Lance flew his ¼-scale EPP Schweitzer 1-26E in the scale competition. The model was built from scratch by Ren DiLeo and is one of the largest EPP models ever made.



Tim Neja made it look easy to launch the 107-inch-span, 11-pound Superfortress on its flawless first flight.



This pair of P-38 twin Lightnings was flown by Cliff Lindgren and Ralph Roberts.

FRIDAY HIGHLIGHTS

Hoping to repeat the success of the last Soar Utah, the IMSF crew planned a side trip to Antelope Island in the middle of the Great Salt Lake on Friday morning. About half of the pilots made the trip to the island and, as always, were treated to amazing scenery with panoramic views of the Great Salt Lake and the Wasatch Mountains. On this trip, however, the wind remained light, so most of the flying was with hand-launched gliders and light-air slope ships. Most pilots returned to POTM on Friday afternoon and were welcomed with 10 to 15mph winds coming straight up the slope.

Friday brought many other highlights, including test flights of Dave Wenzlick's 1/10.5-scale A-10. At 10 pounds, it needed a strong, steady wind to fly, and, for the initial flight, Dave elected to remove the nacelles to avoid any unnecessary drag. This was one of those times when everyone else landed to watch another pilot's flight.

For the ultimate in cool, you didn't need to look, or listen, farther than Southern California boys Brian Laird, Ralph Roberts and Tim Neja, who flew their Czech-made Opus sailplanes from R/C Direct. Something about the hollow molded wings on these planes makes them whistle when the ailerons are deflected. With three in the air at once, we were treated to a virtual symphony of aileron rolls.

Dave Wenzlick knows how to make large, exact-scale models. Tim Neja holds the 10-pound model in preparation for its initial test flight at Point of the Mountain. Note that the nacelles were removed for the initial flights.

PEOPLE'S CHOICE AWARDS

• Modern

1. Mike Lance	DG-600
2. Dave Wenzlick	Nimbus 4
3. Mike Lance	Schweitzer 1-26

• Vintage

1. Mike Lance	Minimoa
2. Tom Hoopes	Northrop Primary Glider
3. Tom Henscheid	Beechcraft Staggerwing

• PSS

1. Carl Maas	B-29
2. Dave Wenzlick	A-10
3. Robert Cavazos	P-63

SCALE COMPETITION

• Modern

1. Mike Lance	Schweitzer 1-26
2. Dave Wenzlick	A-10
3. Arthur Markiewicz	LS-4

• Vintage

1. Mike Lance	Minimoa
2. Scott Marshall	Ka6E
3. Bill Jones	Schweitzer 1-26

• PSS

1. Brian Laird	SUD Caravelle
2. Tim Neja	Super Tucano
3. Mike Lance	P-51 Mustang

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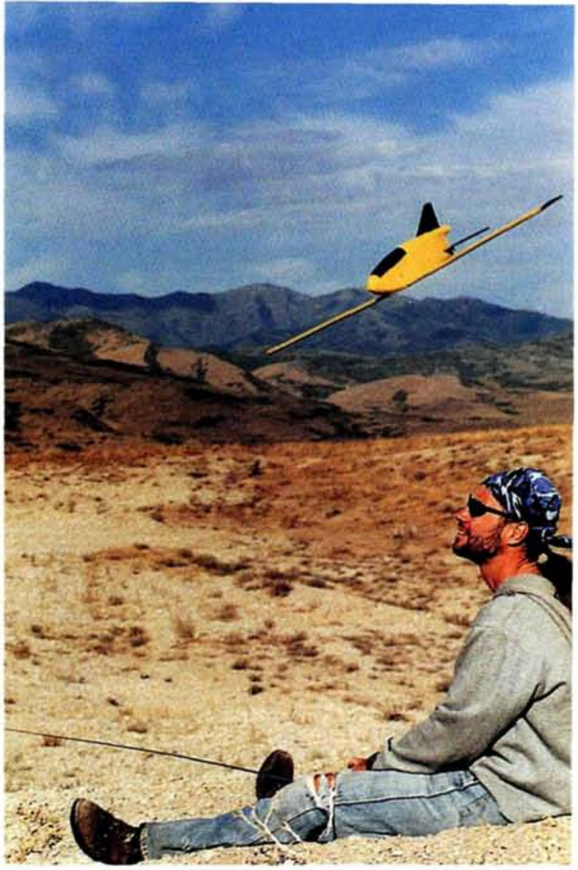
Eric Swenson of Medford, OR, taught us something about how far slope aerobatics have come by flying his ¼-scale Fox on a knife-edge down the length of the slope. I'll bet most people thought that couldn't be done without an engine up front!



Off to the side of the action, Joe Chovan demonstrated close-in aerobatics by practically dive-bombing himself with his Slickraft EPP BD-5. With an all-up weight of 8 ounces, the little BD-5 didn't even make Joe flinch.

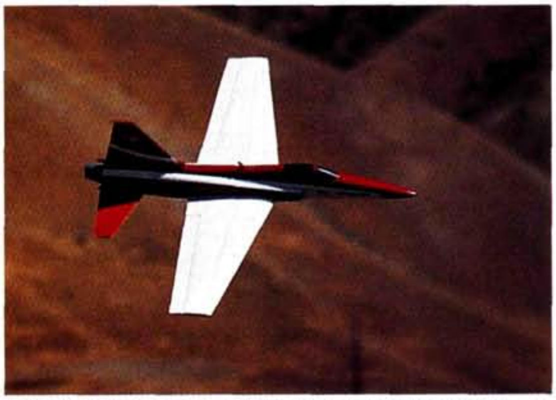
SCALE COMPETITION

On Saturday morning, the official day of the scale competition, the winds started light and grew to an intermittent 10 to 15mph. The pit area was filled with some of the world's finest examples of RC sailplane craftsmanship and ingenuity. For the scale judging, pilots flew a series of six required maneuvers with the option to substitute one maneuver of their choice. The competition also featured a static judging component and pilot's choice awards. Entries were divided into three categories: modern, vintage and power slope scale (PSS).

During the scale flying rounds, the intermittent winds seemed to favor the pilots who flew long-wing scale sailplanes and gave an extra challenge to the PSS pilots. Nonetheless, aces such as Brian Laird, with his scratch-built Air France SUD Caravelle Airliner, and Tim Neja, with his Carl Maas-designed Super Tucano, carved up the sky during their judging rounds.

Mike Lance impressed the crowd with his 1/3.5-scale Minimoa sailplane with its 4.5-meter gull wing. With the sun shining through its translucent covering, the vintage model performed a series of multiple loops, rolls and low, high-speed passes. Mike also had entries in the modern and PSS categories, flying his ¼-scale, scratch-built EPP foam Schweitzer 1-26 and Durable Aircraft Models P-51 in the same type of aerobatic routines.

Dave Wenzlick chose to fly his initial judged round with his 5.28-meter Nimbus 4 sailplane. Dave modified a Gerasis kit, turning it into a motor glider by adding a 5.2:1 geared Hacker B50-9XL brushless motor in the nose turning an 18x11 prop. Equipped with a 20-cell, CP 1700mAh battery, the huge sailplane looked as though it found a monster thermal when Dave gave it throttle! Trading some extreme altitude for airspeed, Dave brought the Nimbus down for screaming high-speed passes and then bent the wings into an amazing S shape as he completed graceful aileron rolls. Dave was also set to fly a judged round with the big A-10, but he found that an aileron servo had been damaged during landing on the test flight the day before.



Brian Laird's slope-scale F-20 Tigershark. This sleek, fast slope jet has a 46-inch span and weighs about 40 ounces. A kit is now available through Cavazos Sailplane Design.

Brian Laird showed off his superb building and flying capabilities with his scratch-built SUD Caravelle.

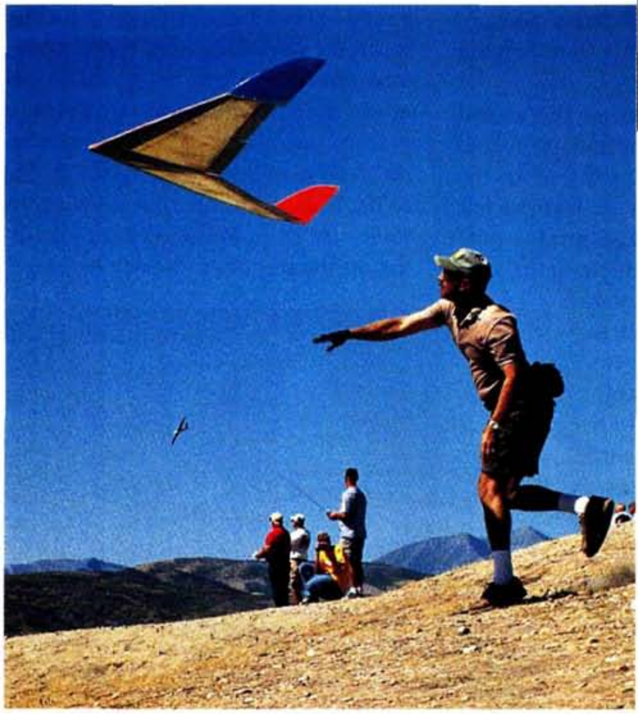
made no flights on this mission. Everyone held his breath as Carl brought the B-29 in on final approach, and the crowd erupted in cheers after a perfect landing on its innovative, retractable landing skids.

Sunday brought another day of flying, with winds a bit lighter than the day before. Tom Henscheid, owner of Mountain Toys in Meridian, ID, showed his innovative use of EPP by flying his Beechcraft Staggerwing—perhaps the only production PSS biplane kit on the market. The Staggerwing had impressive maneuverability, and in Tom's hands, it positively danced through the sky.

A "SUPER" PERFORMANCE

This year, two Carl Maases participated. Truth is, it took both Carl Sr. and Carl Jr. to design, build and fly their huge 1/16-scale B-29 Superfortress. Weighing 11 pounds, with a length of 75 inches, the 107-inch-span Superfortress needed strong, steady wind before either Maas was willing to toss it off the hill. An opportunity arose on Saturday afternoon, and it was not wasted. With Carl Jr. at the Hitec Eclipse transmitter, Tim Neja performed the launch duties. Carl Jr. proceeded to impress the crowd with more than 10 minutes of high- and low-altitude bombing runs. He even coaxed a roll or two out of the massive bomber. On one pass, the bomb-bay doors opened, and a load of plastic ordnance was dropped to the cheering audience. The bomb bay is interchangeable with a box fitted to drop an RC X-1 rocket plane, although the X-1

Mike Lance's 1/3.5-scale Minimoa is launched during the judging round.



Art Markiewicz's 10-foot-span giant flying wing, the Mothership, dwarfs all other planes on the slope. The Mothership has elevons and flaps that allow it to slow nearly to a crawl.

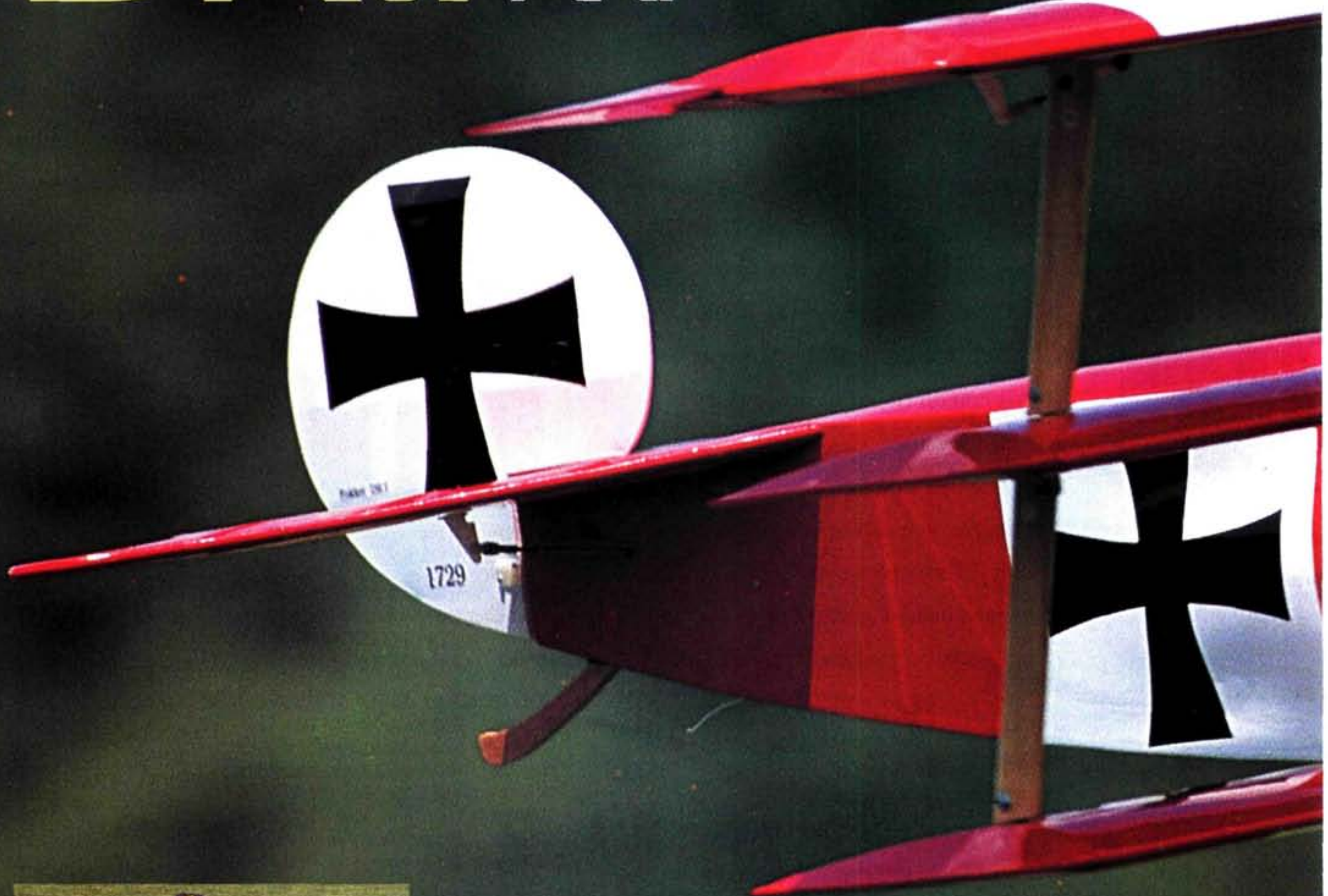
EXTREME SOARING

Monday's trip to Francis Peak was a great success. This awe-inspiring site is 5,000 feet above the valley floor, 10,000 feet above sea level and offers pilots spectacular views of the valley below and the Great Salt Lake. Those who made the trip were rewarded with clear blue skies and plenty of wind blowing right up the mountain from the valley below. A few pilots took advantage of the steep back side of the mountain to show their skills at dynamic soaring. By taking advantage of the separation layer at the crest and the shadow zone on the downwind side of the mountain, they accelerated their planes to phenomenal speeds before pulling into seemingly endless vertical climbs. This was extreme soaring at its best.

Soar Utah 2002 was a fine example of what slope soaring—and model airplanes in general—are all about. It challenges pilots to design, show and fly planes that no one has built before and to fly maneuvers that no one has flown before while providing a chance to meet up with old flying buddies at some of the best slopes in the United States. See you in 2004!

If you would like more information on Soar Utah or the InterMountain Silent Flyers, check out the website at www.silentflyer.com.

Great Planes FOKKER DR.I ARF



by Nick Ziroli Sr.

I have been building model airplanes for more years than I care to think about, and I've learned to recognize good engineering and *high-quality construction. A critical inspection of* the Great Planes almost-ready-to-fly (ARF) Fokker Dr.1 indicated that it excels in both these areas. This is an all-built-up model that is beautifully covered with *Top Flite MonoKote film. I came across a* few minor items that I thought could have been improved, but when a model is this good, it's difficult to find serious faults.

PHOTOS BY WALTER SIDAS

Re-create WW I with this great flying classic

LET'S GET STARTED

This is a very complete kit. You'll need a radio system with five servos, a Y-harness and servo extensions and a prop and fuel line. A .46 to .60 2-stroke engine or a .52 to .70 4-stroke engine is recommended; I went with an O.S. FS-70 Surpass and found it to be a very good match for the Dr.1. The only other item that is optional—but should be installed—is a ⅕-scale pilot bust. The excellent 35-page assembly manual is well illustrated with many detailed photos, and it includes a list of required accessories and tools. I used Zap CA and epoxies throughout.

• **Landing gear.** Assembly begins by mounting the prebuilt and painted landing-gear assembly on the fuselage. All holes are accurately predrilled for the sheet-metal mounting screws; you just need to file or grind flats at the ends of the axles for the wheel-collar setscrews. The tailskid is made out of prefinished plywood and has been epoxied into a socket at the rear of the fuselage. I thought it could easily be broken off, but dozens of flights have proven me wrong.

• **Wing assembly.** Completing the bottom and middle wings involves gluing the wing-mounting dowels in predrilled holes and mounting the strut brackets using sheet-metal screws. As with the landing gear, all holes are predrilled. The strut-mounting brackets are heavy steel, each with one hole tapped for the strut-retainer screw. Some brackets are bent to 90 degrees and some to 60 degrees, so be careful to position them properly.

The top-wing assembly involves mounting servos and ailerons. You are instructed to permanently hinge the ailerons first. Instead, I chose to fit the CA-type hinges and glue them only to the ailerons. Make sure that the ailerons fit properly. Note how the white field and black cross line up perfectly. Cut open the servo openings, and mount the precovered covers using sheet-metal screws. Remove the covers, and mount the servos on the wooden blocks that have been epoxied to the inside of the plate. You'll need a Y-harness and one 12-inch and two 6-inch extensions to connect the servos to the receiver. The manufacturer was thoughtful and built a string into the wing that can be used to pull the leads through. Remount the servos, and put the ailerons into place. Position the horns and mark their locations, then remove the ailerons and mount the horns. This is much easier to do before the ailerons have been installed. Glue the aileron hinges into the wing, and install the pushrods. Mount the strut brackets to complete the top wing.

Mount the bottom and middle wings on the fuselage. I decided to add a balsa filler block between the mounting plate and the wing surface at the wing-mounting screws; this takes the bending strain off the mounting plates. Mount the lower interplane struts. These are made out of hardwood, are well finished and are numbered so there is no question where they should go. Socket-head capscrews hold the struts in place. Fit the center-wing cover to the center wing, and glue it into place. I found it best to leave a small flange at the wing surface, since this part is a little short to evenly fit

SPECIFICATIONS

MODEL: Fokker Dr.1

MANUFACTURER: Great Planes

WINGSPAN: 60.5 in.

WING AREA: 1,367 sq. in.

WING LOADING: 14.4 oz./sq. ft.

LENGTH: 49.5 in.

WEIGHT: 8 lb., 9 oz.

ENGINE REQ'D: .46 to .60 2-stroke or .52 to .70 4-stroke

ENGINE USED: O.S. FS-70 Surpass

PROP USED: Zinger 14x6

RADIO REQ'D: 4-channel w/5 servos (rudder, elevator, throttle and two ailerons)

RADIO USED: Airtronics RD6000 Super transmitter, Micro 92777Z FM receiver, five 94102 standard servos and 1200mAh flight pack

FUEL USED: Cool Power 15%

PRICE: $299.99

FEATURES: all balsa and ply, built-up construction, three one-piece wings; MonoKote covering; white fiberglass cowl, wheels, formed-wire landing gear and all necessary hardware included.

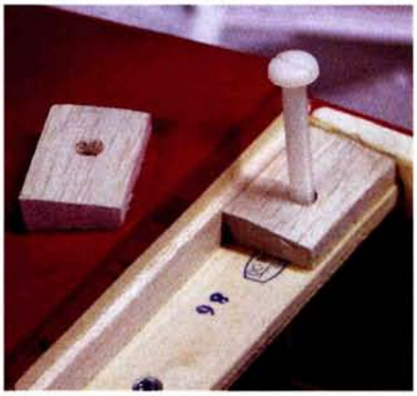
COMMENTS: with its high-quality workmanship and materials, expertly applied covering and good flight performance, this is a very cost-effective model; I doubt it could be constructed from a kit for less.

HITS
- High-quality construction and materials.
- Very complete, with good hardware included.
- Excellent instruction manual.
- Good flight performance.

MISSES
- None.

All you have to do is add a military pilot, and you'll be set to "strafe the trenches."

with the fuselage. With the guns in place, it isn't very noticeable. Now, mount the last two 90-degree brackets on the nose of the fuselage. Attach the prepainted sheet-metal cabane struts (very nice!) to the fuselage, then add the top-wing and interplane struts. All of my wings lined up perfectly.

Left: with the middle wing removed, you have access to the battery and receiver. Note that the fuel tank sits below the battery. Right: I added these spacer blocks under the wing hold-down bolts for the middle and bottom wings.

• **Tail feathers.** Cut away the MonoKote on the stabilizer and fuselage so there will be a wood-to-wood glue joint when it is mounted. Test-fit the hinges, but don't glue them yet. Set the stabilizer in place, and check to make sure that it's parallel with the center wing when it's viewed from the rear. I needed to add a very thin shim under one edge. Align the stabilizer to the center of the fuselage, and glue it into place. Hinge the rudder. At this point, I glued the hinges to the elevators and rudder only. As with the ailerons, I prefer to attach the control horns before I hinge them.

ENGINE INSTALLATION

Remove the wings, and bolt the motor mount to the firewall. A template is provided to accurately position the mount to suit a variety of engines. I highly recommend the O.S. FS-70 Surpass. Position the engine on the mount, mark the hole locations, drill and tap the holes and screw the engine into place. Align the throttle arm with the firewall, and drill a hole for the pushrod. Make sure that it will clear the fuel tank inside.

The pushrods are 0.074 inch in diameter and go through slightly curved guide tubes. I fit each pushrod to the tubes by slightly arching them. A little trial and error will make them fit freely for the inch or so that they will travel. I used five standard Airtronics 94102 servos with 50 oz.-in. of torque, and this proved to be adequate. There is enough room in the servo mount for an additional servo on each elevator, if you like. With the control surfaces in place, mark the correct position of the control horns. Remove the control surfaces, mount the horns and then permanently glue them into place. Install all the radio systems, and set up the control throws, as indicated.

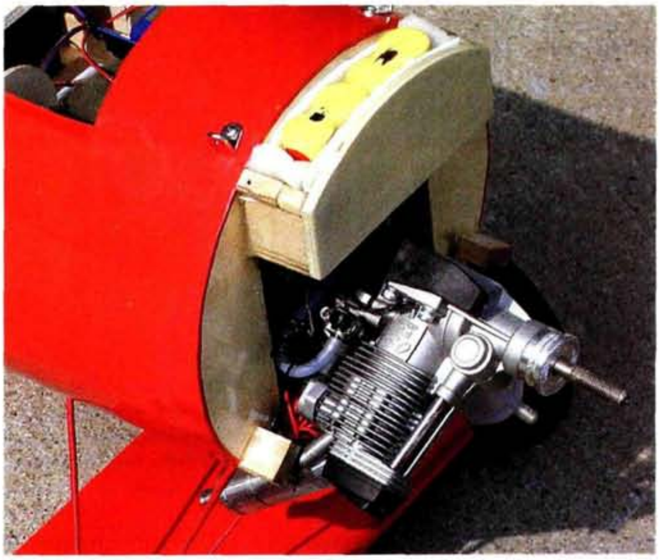
LAST TOUCHES

Epoxy the four cowl-mounting blocks to the firewall; make sure that the one by the cylinder head does not interfere with the glow plug. I installed a Sonic-Tronics no. 443 Remote Glow Plug Adapter. Without this, I would have had to cut away a portion of the cowl to access the glow plug. Install the cowl and dummy engine cylinders.

A set of landing-gear strut fairings is included. I installed one, but I really didn't care for its appearance, so I removed it and left the struts with their painted red finish. When I installed the landing-gear wing using the predrilled mounting holes, it sat at a 10-degree negative angle to the rest of the wings. I repositioned it to make it even with the wings and drilled new holes. Mount the wheels and add the cockpit coaming and step. I also added a Williams Bros. ⅕-scale standard pilot figure. A pair of very nice, wooden replica machine guns is included with the model. Their bottoms have to be cut to fit the curve of the fuselage. I glued a small block at the forward end of the barrel to help support the guns.

I wanted the model to balance a little farther forward, so I built a battery box

How's this for climb performance?



To move the balance point forward, I made a plywood battery box and attached it to the firewall just above the engine.

over the engine to fit a 1200mAh airborne pack. I can't truthfully say this made a great deal of difference.

Add the self-adhesive lettering, and the Dr.1 is complete.

FINAL THOUGHTS

The Dr.1's flight performance is very good, and the OS FS-70 is an excellent match for the model. I've been running a 14x6 Zinger prop, but I'm sure that you could get even better performance with a smaller, higher pitch prop, if you wish.

The Great Planes Fokker Dr.1 is a great model of a very well-known WW I airplane. It always draws a lot of attention, whether it's sitting on the ground or flying. It's a good value and should be suitable for any modeler who has a reasonable amount of flying experience.

Airtronics (714) 978-1895; airtronics.net.
Cool Power; distributed by Morgan Fuel (800) 633-7556; morganfuel.com.
Great Planes Model Mfg.. (800) 682-8948; greatplanes.com.
Sonic-Tronics (215) 635-6520; sonictronics.com.
Williams Bros. Inc. (805) 534-1307; williamsbrosinc.com.
Zap Glue; www.zapglue.com.
Zinger Props; distributed by J&Z Products (310) 539-2313; zingerpropeller.com.

FLIGHT PERFORMANCE

Be sure to set up the engine properly before you fly the Dr.1; it doesn't glide well, so deadstick landings are not desirable. The lower control throws are a good starting point. They can be fine-tuned to your liking as flight time is accumulated.

TAKEOFF AND LANDING

The Dr.1 prefers to operate off grass. The lack of a tailwheel makes it very squirrelly on pavement; takeoffs aren't too difficult, but landings usually end in a ground loop. Even on grass, the landing isn't over until the plane has stopped! I have flown my Dr.1 many times, and I have had it on its nose only once and I have never broken a prop.

LOW-SPEED PERFORMANCE

Low-speed control is very good, right up to a stall. With its light wing loading of 14.4 ounces per square foot, it never abruptly stalls. The Dr.1 will mush ahead or fall off to one side or the other, depending on its relationship to the wind. In a brisk breeze, it will hang like a kite, hovering under full control.

HIGH-SPEED PERFORMANCE

This isn't a high-speed airplane, and it's seldom flown at full throttle. It does tend to climb at full power, which is fine; if you are at full power, that's probably what you want it to do. On the other hand, if the power is reduced, as in a landing, the nose drops and makes approaches easier.

AEROBATICS

Mild aerobatics aren't a problem for the Dr.1. Loops, rolls, Immelmann turns, stall turns, and so on are easy to perform. Inverted flight is a little tricky; the plane tends to roll out, especially if you get a little behind on the controls. It does like rudder input for nice coordinated turns, and most transmitters, including the Airtronics RD6000, allow you to couple the rudder to the ailerons to make this easier. It's a fun airplane to fly.

FLYING THE RED BARON'S STALLION

When you're strapping yourself into a Fokker Triplane, the difference between it and most other airplanes is palpable. The instrument panel doesn't exist, and the few rudimentary gauges are snuggled between the butts of two dummy Spandaus that seem to be almost in your face. When you look outside, the middle wing sits exactly where you'd look if you were landing a normal tail-dragger, and just having three tremendously stubby wings out there makes for a really strange feeling.

On this flight, I knew the more modern (1930s) 145hp Warner engine up front eliminated the wild gyroscopic effects that the original 110hp Oberusel rotary engine caused and provided an actual throttle, not an intermittent kill button. Still, there was no doubt that I was about to fly an unusual airplane.

By the time I got to the runway, it became obvious why the middle wing had a cutout at the root: you need it to see where you're going. Even making lots of S-turns, I was constantly ducking down to look under the wing to see what was in front of me.

Baron Manfred von Richthofen gained worldwide notoriety as the "Red Baron."

Takeoff was a revelation. I'd barely started the throttle forward when the tail was ready to pop up off the runway. Instantly, the visibility increased a hundredfold, and the airplane floated off in a nearly level attitude at an unbelievably low speed. The first airspeed I saw was 60mph, and it was already climbing like a bandit.

To a modern pilot, this airplane can be thoroughly disconcerting; it takes some getting used to. It has zero yaw stability, and the rudder has virtually no feel. In level flight, if you take your feet off the rudder bar, the nose will gradually slide one way or the other, so you're constantly futzing with the rudder to keep the ball centered. Even in turns, I could feel my butt sliding back and forth and the wind hitting one side of my face and then the other. The changing direction of the slipstream was actually the best indication of what the airplane was doing. It's a different way to fly, and the upcoming landing constantly haunts you.

The good news about landing a Fokker Triplane is that everything happens in slow motion. It approaches at about 70mph, and the nose is well down because of all that drag, so visibility is good—until you flare. In a three-point attitude, the entire world disappears and everything gets very quiet as the airplane slows to its 40mph stall.

On touchdown, I found myself looking under the middle wing, desperate for anything that gave me ground references. I don't know why I even bothered looking because, as the airplane slowed down, it was obvious that I was more a passenger than anything else. If there had been a hint of crosswind, I doubt if I could have kept it straight.

During the Great War, airfields were big rectangular patches of grass and you always landed into the wind. There's a reason, however, that Triplanes have axe-handle skids under the wingtips. And there's a reason Triplane pilots don't feel embarrassed when they ground loop one. It will happen to everyone, sooner or later.

I survived my first landing without embarrassment, and I didn't go back for a second. I'm not stupid. —*Budd Davisson*

[Editor's note: a certified flight instructor for more than 35 years, Budd has logged more than 6,000 hours in nearly 300 types of aircraft, including many WW II fighters. He is also the editor-in-chief of our sister publication, Flight Journal.}

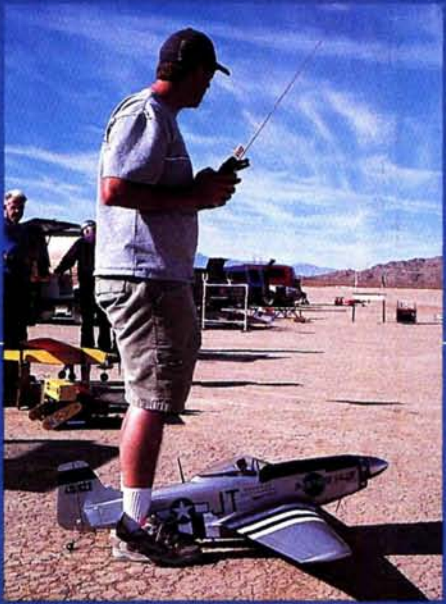
Conquer the skies with this quick-build warbird

by John Reid

In service throughout WW II and into the Korean War, the P-51D Mustang is probably the world's most recognized plane, and Model Tech has reproduced one of the most attractive versions—the Short-Fuse Sallee. The full-size Short-Fuse Sallee still flies over Minneapolis, MN, and is owned by Bill Bruggeman.

With its .46 ARF, Model Tech has done a fine job of reproducing the feel and look of this great fighter plane. This sport-scale model maintains the scale outline of the full-size plane and has an enhanced airfoil that provides outstanding performance.

Model Tech P-51D ARF



FLIGHT PERFORMANCE

TAKEOFF AND LANDING

On the ground, this is probably one of the most docile RC P-51s. You need to be quick on the sticks during takeoff to prevent it from nosing over because the tail comes up as power is applied. This gives you very good rudder control right away. I needed only a little right trim and down-trim to get level flight.

The P-51 is a breeze to land, especially on a calm day. On final approach, the throttle should be at ¼; once the plane has passed the end of the runway (ideally, about 4 to 6 feet above the ground), chop the throttle to idle. Use the ailerons to keep the wings level with the runway and the rudder to keep the plane on course down the center; then let the plane settle onto the runway. Just before the wheels touch the ground, add a little up-elevator for a 3-point touchdown.

SLOW-SPEED PERFORMANCE

The slow-speed characteristics of this plane are great! When you do get it to stall, it will do so straight ahead without any tendency to drop either wingtip, and it will recover quickly. Control responses are not quite as quick as they are at higher speeds, but the plane is extremely stable and responsive at slower speeds. With a little up-trim, I easily maintained level flight at ½ throttle and had very good control at ¼ throttle.

HIGH-SPEED PERFORMANCE

With the Magnum XL .61RFS up front, the plane was not over-powered, but it did have a very realistic, scale, flight performance with regard to speed and sound. A continual 30-degree climb is no problem, but a vertical ascent will quickly slow the plane until it falls out of the climb. If you really want to hot-dog it around the sky, you will need a stronger engine, but if you enjoy its scale flight performance, this engine is perfect.

SPECIFICATIONS

MODEL: P-51D Mustang ARF

MANUFACTURER: Model Tech

DISTRIBUTOR: Global Hobby Distributors

TYPE: semi-scale warbird

WINGSPAN: 57 in.

WING AREA: 612 sq. in.

WEIGHT: 6 lb., 8 oz.

WING LOADING: 24.47 oz./sq. ft.

LENGTH: 51 in.

ENGINE REQ'D: .46 2-stroke or .61 4-stroke

ENGINE USED: Magnum XL .61 RFS 4-stroke

RADIO REQ'D: 5-channel w/4 standard servos and 1 retract servo (elevator, rudder, throttle, ailerons & retracts)

RADIO USED: Airtronics RD6000 with a Hitec Supreme receiver and 4, HS-425BB deluxe servos and 1, cirrus CS-100 low-profile retract servo

FUEL USED: Powermaster 15%

PROP USED: Zinger 12x7

STREET PRICE: $199.99

FEATURES: all balsa-and-plywood construction; iron-on covering; 63-page manual; fully sheeted wing; complete hardware package; aluminum spinner and retracts.

COMMENTS: the Model Tech P-51 is a well-built model that has excellent flying characteristics.

HITS

- Fully sheeted wing.
- Retracts and aluminum spinner are included.
- Flies great.

MISSES

- Engine compartment is tight for the recommended 4-stroke engine.

AEROBATICS

This plane can do a wide variety of aerobatics in a scale-like manner. Loops, rolls, hammerheads, tail slides and snap rolls are all easy to do. Rolls are very axial and require just a little elevator input to maintain level flight. Inverted flight requires some down-elevator to keep the plane level. I was even able to get the P-51 to do a Lomcevak (not as well as a stunt plane can do it, but it did look good). The large rudder made it easy for me to hold a knife-edge for the full length of the field.

The model is built up entirely of balsa and plywood, the wing panels are fully sheeted, and the model is entirely finished with iron-on covering. A full hardware package, fuel tank, retractable and fixed landing gear, decals, a tailwheel and a polished chrome spinner are also included. There are various molded-plastic parts and an excellent 63-page manual with building checklists, photos and drawings that cover all aspects of the construction.

ASSEMBLY

Wing. I started by test-fitting the wing panels to each other with the dihedral brace in place. I had to sand the dihedral brace a little to get a perfect fit. When the joint was tight, I applied a generous amount of 30-minute epoxy to the wing roots and dihedral brace. After I had made sure that I had a tight joint, I held the assembly together with 1½-inch-wide masking tape until the epoxy had dried, then I installed the leading-edge plywood-support brace with 5-minute epoxy. The brace helps to support the wing dowels and the leading-edge fairing that is installed later.

I mounted the wing on the fuselage. After measuring the locations of the wing-mounting bolts on the wing, I aligned the wing with the fuselage in the wing saddle and taped it into place. I carefully drilled two, 3⁄16-inch pilot holes through the wing and into the fuselage plywood blocks. I removed the wing and enlarged the holes in the blocks to fit the two supplied blind nuts. I removed just enough covering around the bolt holes in the wing to glue the doubler over the holes to reinforce that area. When all the wing alignments checked out, I installed the radiator scoop. The instructions suggest that you use epoxy to attach the wooden braces inside the plastic parts, but I decided to use canopy glue, and that really holds all the braces on the plastic, even when the parts flex. I held everything in place with masking tape until it had dried. With the plastic scoop mounted and the wing bolted to the body, I moved on to the tail feathers.

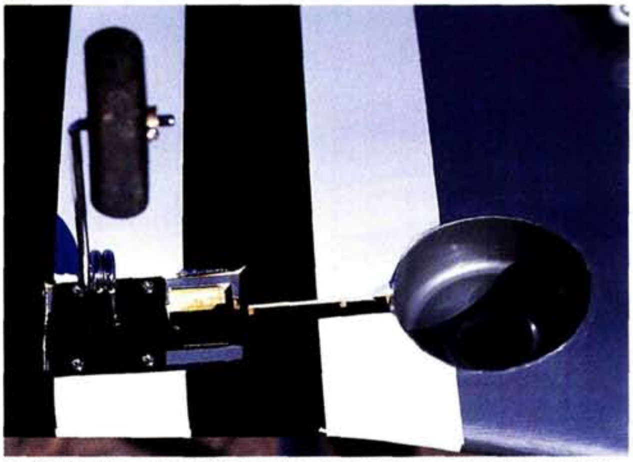
Tail feathers. I knew that the wing alignment was correct, so I used it as a reference point to line up the stabilizer. When I was satisfied that the stabilizer was centered, I secured it in place with T-pins. I used a marking pen to draw lines to indicate where the stabilizer would exit from the fuselage on the top and bottom, and I removed the covering between these lines. If you use a hobby knife to remove the covering, use just enough pressure to cut through the covering; don't cut into the wood! I inserted the stabilizer into the fuselage, right up to the bare wood. I spread the epoxy over the stabilizer and slid it back into place so that all of the lines matched up with the fuselage. After locking the stabilizer down with T-pins, I rechecked its alignment and removed the excess epoxy with alcohol and a paper towel.

After the stabilizer epoxy had dried, I started on the vertical tail fin. Again, remove the covering where the fin fits into the slot in the fuselage. I liberally applied epoxy to the slot and inserted the fin into it, checking to make sure that the fin was 90 degrees to the horizontal stabilizer.

At this point, I installed the control surfaces with the CA hinges provided in the kit. I drilled a small hole through the middle of the hinge slot to help disperse the CA to the back of the hinge.

Retracts. I moved back to the wing to install the retractable landing gear. The kit comes with fixed and retractable gear, but this P-51 deserves retracts! I installed the recommended Cirrus CS-100 low-profile retract servo first, then I removed the covering from the two landing-gear mounts and wheel wells. Before I drilled holes in the gear mounts for the retracts, I set the plastic wheel well in place and attached the wheels to the landing gear. Then I was able to move the gear back and forth until everything lined up. Next, I drilled the pilot holes for the screws and, confident that everything was in the correct place, I screwed the retracts into place.

I routed the pushrods to the retract servo and attached them with adjustable servo connectors. It is important to bend the pushrods at the servo as shown in the manual. This ensures that the wires clear each other when the servo travels as the gear goes up, and it gives some flexibility to relieve the stress on the retracts. I used canopy glue to seal the plastic wheel wells into place, and when the glue had dried, I trimmed the wells flush with the wing.



Installing the retractable landing gear is simply a matter of removing the covering, screwing in the retracts and attaching the wheel wells to the wing. The retracts have performed flawlessly for more than 30 flights.

The cowl needs only minimal cutting to provide adequate cooling.

Engine installation. Mounting the engine is pretty straightforward. I used a Magnum XL .61 RFS to power my

Jim Blanner holds his electric conversion of Short-Fuse Sallee in front of the real thing! This beautiful Mustang is owned by William "Bill" Bruggeman who flies it out of the Janes Field/Blaine Airport in Minneapolis, MN.

Mustang. I installed the spinner backplate and prop on the engine and used that to line up the engine on the hardwood beams. Then I drilled pilot holes, secured the engine in place with four wood screws and rechecked its alignment. I removed the engine, flowed CA into the screw holes to strengthen the wood, drilled a hole for the pushrod (leaving enough space for it to clear the tank) and then reinstalled the engine. The Magnum XL .61 RFS is a very tight fit in the engine compartment, so it took some work to route the pushrod past the tank and to the carburetor, which is right next to the firewall. When I had bent the pushrod correctly, however, everything worked great. I mounted the tank using silicone sealant to secure it to the fuselage and to seal the tank hole in the firewall.

Radio gear. I installed the servo trays in the fuselage and wing with thick CA. I test-fit the servos first and then removed them, wicked thin CA into the servo-screw holes and installed them permanently. The rudder and elevator have small pushrod tubes that are guided through the fuselage by larger pushrod-housing tubes. I inserted the plain end of a threaded wire (along with some CA) into the end of the small pushrod tube so that the tube would have threads for the clevis. Two of the wires slid into the pushrod tubes with no effort, but the third was a very tight fit; I could get it only halfway in. I managed to slide it the rest of the way by holding it in the chuck of a variable-speed drill and slowly rotating it as I gently pushed it in. If you need to use a drill, don't run it at high speed because the plastic pushrod tube will melt. With the servos installed, all that was left to do was to add the canopy, cowl and trim.

I added a little paint to my model's canopy. I also installed a scale pilot in the cockpit and used canopy glue and screws to fasten the canopy in place.

FINAL TOUCHES

The canopy needed to be painted, so I masked it off with a thin strip of electricians' tape and used aluminum and black LustreKote to match the model's color. I installed a Cermark pilot figure (be sure to use screws to hold it in), and I secured the canopy to the fuselage with canopy glue and four screws. I also used canopy glue to attach the wing fairings to the wings.

I used a rotary tool to make the cutout in the cowl for the engine head, the muffler and the needle valve. The cowl is held in place with four flat-head screws, and I mounted the prop and included aluminum spinner on the engine to complete the construction of the front of the plane.

I applied the decals by removing their backing paper and dipping them in a tray

Electric conversion

When Jim Blanner first heard about the Model Tech P-51D, he said he knew that it would be an ideal plane to convert to electric power with very few modifications. In Jim's model, an Aveox 27/39/2 motor and an MEC Superbox 60/20 gearbox spin a 4-blade, 15x11 APC prop at 6,300rpm! Two MEC Sport Packs with 18, 3000mAh NiMH cells and an Aveox SH-40 speed control allow the motor to produce ¾hp and an estimated 7.7 pounds of thrust—more than enough to muscle Jim's 8-pound, 3-ounce plane through the sky with plenty of power and speed. A full article on Jim's electric conversion will appear in a future issue of *Model Airplane News*; stay tuned!

The Aveox 27/32/2 motor with the Model Elecrtronics Corp. 60/20 gearbox is a light powerhouse that produces approximately ¾hp on 18, 3000mAh cells.

To properly position the gearbox output shaft in the Mustang's nose, you must raise the assembly slightly. Hardwood blocks screwed into the engine bearers work well for this. Note the cooling air holes in the firewall.

of water containing a few drops of dishwashing liquid. This solution allowed me to slide the decals until they were in the right positions. I used my hand and a cloth to squeeze out the air bubbles and flatten the decals.

I wrapped the receiver and battery in foam and moved them back and forth in the roomy fuselage to balance the airplane. The CG is 4½ inches back from the leading edge of the wing. By moving the receiver battery toward the back of the fuselage, I achieved the proper balance without adding weight. For the first flight, I set the rudder, elevator and ailerons to the recommended control throws.

CONCLUSION

The Model Tech P-51D Mustang is an excellent flyer. Its scale outline and silver and black "invasion" stripes really stand out when it's in the sky. The sound of the 4-stroke engine and the gear folding up into the wing also adds to the plane's scale realism. If you enjoy watching a P-51 doing a low flyby and pulling up into a victory roll (who doesn't?), you will want this plane.

Once you start to fly it, you will realize that you can never do too many low flybys with a Mustang. ✈

Airtronics *(714) 978-1895; airtronics.net.*

APC Props; *distributed by Landing Products (530) 661-0399; pcprop.com.*

Aveox Electric Flight Systems *(818) 597-8915; aveox.com.*

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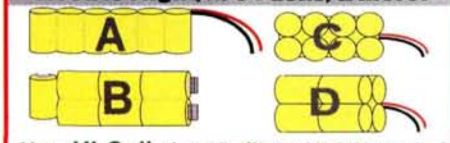

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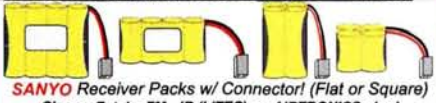

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Female (Receiver, 3-wire) w/12" lead	$ 2.00ea.
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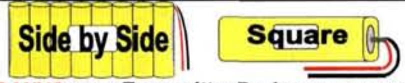
24" Extension (1 male, 1 female)	$ 4.00ea.
36" Extension (1 male, 1 female)	$ 4.50ea.
Y-Connector (1 male, 2 female)	$ 5.50ea.
Switch Harness (2 male, 1 female)	$ 6.50ea.



SANYO Ni-Cd Transmitter Packs with wire leads.
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An all-time favorite in ¼ scale

The World Models Mfg. PIPER J-3 CUB

by Jim Onorato

The Piper J-3 Cub is probably the most recognizable airplane ever built. It first appeared in 1935, and by the beginning of WW II, more than 5,000 had been produced! This enormously popular, two-man trainer is said to have introduced nearly 75 percent of WW II aviators to flight. It also helped prove to the public that airplanes could be economical and safe. This ¼-scale version is one of many well-made ARFs manufactured by The World Models Mfg. Co., and it's distributed exclusively by AirBorne Models.

The Cub is a very complete kit; you need only add an engine of your choice, a 4-channel radio with 5 servos and a fuel tank.

WHAT'S IN THE BOX?

I'm amazed at how far the industry has come in the development of ARFs. This 104-inch-span plane comes in a single box and is nearly complete. I was pleased by the excellent quality of materials and workmanship that went into this model. It's constructed mainly of balsa and expertly covered with Oracover. There were very few wrinkles in the covering, and the seams were almost invisible. The one-piece fiberglass cowl has been expertly spray-painted to match the covering. The included, clear plastic dummy half cowl makes positioning the cutouts for the engine very easy. The wing panels and the tail feathers are built up, and all the control surfaces have been installed with glued hinges and almost no gap. I was particularly impressed with the fully assembled landing gear; it had the best-looking wrapped solder joints I've ever seen. Vacuum-formed windows and canopy, scale wheels with Cub hubcaps, tailwheel, engine mount, push-rods, hinged wing struts and a complete hardware package (with metric nuts and bolts) are included. To finish the model, you'll need a 4-channel radio with five servos, a .90 2-stroke engine or 1.20 to 1.60 4-stroke engine and a fuel tank.

An 11-page instruction booklet guides you through assembly without the need for full-size plans. The booklet has only 26 steps and includes a lot of symbols and drawings with very few words. Most dimensions are given in millimeters and inches.

WING ASSEMBLY

The Cub wing requires almost no work because the ailerons have been installed with the glued hinges. You only have to remove the covering from the aileron servo wells and install one servo in each wing panel, control horns and linkages. A factory-installed piece of string in each wing half allows you to easily route the servo leads through the wing ribs to the center. Nice touch!

I attached the preassembled wing struts and braces to the wing with bolts through blind nuts that were already installed in the wing. The bolt-hole positions are shown in the instructions, so you can easily find them to remove their coverings. The left and right struts must be straight before you bolt them into place. Try each brace in both directions; you'll know when you've got it positioned correctly because it will fit in only one way. Although the struts are sturdy, I didn't like the metal hinge at the fuselage end. It's quite long, and it holds the strut too far from the fuselage.

ENGINE INSTALLATION

I always check the firewall installation on an ARF. This one was well reinforced with triangle stock and had been adequately glued in place; it was also fiberglassed to make it stronger and fuelproof. I installed the two-piece, composite engine mount using the provided bolts and blind nuts. I decided to use a Saito FA 1.50 4-stroke engine; it turned out to provide a lot more power than the Cub required, but, as they say, you can always throttle back! I then wrapped a Sullivan 16-ounce tank in foam rubber and installed it directly behind the firewall, with the two fuel lines and a stopper protruding through a factory-drilled hole in the firewall.

The fiberglass cowl is painted and matches the Oracover film. The clear plastic dummy cowl makes it a snap to cut the engine opening.

It's always nerve-wracking to take a Dremel tool (or another device) to a beautifully finished cowl to make the engine and muffler openings. To eliminate your anxiety, The World Models provides a clear plastic dummy half cowl to temporarily attach to the fuselage so you can precisely trace on the dummy the locations of the cutouts. Then remove the dummy and cut out the openings. After making sure they are all in the right places, place the clear dummy over the painted cowl and transfer the cutout locations. Really slick! After I had made the cutouts, I attached the cowl using four small, sheet-metal screws. I was a bit disappointed that there wasn't a dummy engine head to attach to the left side of the cowl. The manufacturer informs me that later versions of the kit include the dummy engine head.

Next, I attached the strut-attachment plates, the landing gear, the landing-gear covers, the wheels and the Cub hubcaps using the provided hardware.

SPECIFICATIONS

MODEL: Piper J-3 Cub

MANUFACTURER: The World Models Mfg. Co.

DISTRIBUTOR: AirBorne Models

TYPE: 1/4-scale sport ARF

WINGSPAN: 104 in.

WING AREA: 1,585 sq. in.

WEIGHT: 13 lb., 10 oz.

WING LOADING: 19.8 oz./sq. ft.

LENGTH: 65 in.

RADIO REQ'D: 4-channel with 5 servos (elevator, rudder, throttle and two ailerons)

RADIO USED: Futaba Conquest with 5 standard servos (148s) and an R127DF receiver

ENGINE REQ'D: .90 2-stroke or 1.20 to 1.60 4-stroke

ENGINE USED: Saito FA 1.50 4-stroke

FUEL USED: Red Max 15%

PRICE: $429.99

FEATURES: built-up balsa wing and tail feathers; balsa construction with Oracover film covering; painted fiberglass cowl; transparent dummy half cowl; all control surfaces installed with glued hinges; assembled landing gear; all necessary hardware included.

COMMENTS: this J-3 Cub is a well-made ARF that is very easy to assemble and should give many hours of leisurely flying fun to all Cub lovers.

HITS
- Excellent flight performance.
- Good overall appearance.
- Precision engineered for easy assembly.
- All hardware included.

MISSES
- No decals or dummy engine.
- Wing struts don't look scale.

FLIGHT PERFORMANCE

FLIGHT PERFORMANCE

First flights were made from a grass runway on a sunny, moderately windy day, with controls set at the recommended rates.

TAKEOFF AND LANDING

Takeoffs are Cub-like, as the tail lifts quickly and the plane accelerates until it lifts itself into the air. The Cub's very shallow glide angle and light wing loading give it beautiful, scale-like landings. Wheel landings are pretty, but be prepared for a long approach because the Cub just wants to keep on flying.

LOW-SPEED PERFORMANCE

One of the things I like best about the J-3 Cub is that it flies very stably at scale-like speeds. Its stall speed is very low, and the stalls are very gentle. It's just as likely to drop either wing, but by the time that happens, the Cub is almost standing still.

HIGH-SPEED PERFORMANCE

With the Saito 1.50 at full throttle, the J-3 flew much too fast to look realistic. A good 1.20-size 4-stroke would be more than enough power for most flying. I did not notice any bad tendencies at top speed.

AEROBATICS

The Piper J-3 Cub isn't, nor was it intended to be, very aerobatic. It will do graceful inside loops, it can be coaxed into a lazy spin and it will do a decent axial roll with a lot of aileron, rudder and elevator coordination. It will even fly inverted, but all of that seems somewhat unnatural for a Piper Cub. It's very sensitive to pitch control and does great-looking hammerhead turns.

I like the smooth, stable, scale-like flight of this Cub, and I plan to enjoy it for a long time.

TAIL FEATHERS

Before I installed the tail feathers, I attached the wing to make sure that everything lined up properly. The wing panels are plugged onto two aluminum tubes and are held in place by four small sheet-metal screws that are threaded into the tubes through the bottom of the wing. If things didn't line up, I figured it would be a lot easier to adjust the tail feathers than the wing, but as it turned out, when I installed the tail feathers, everything lined up perfectly without any need to cut or shim. I was really impressed by how precisely this ARF was manufactured.

I assembled the tailwheel (a leaf-spring type) and connected it to the rudder with small coil springs; then I attached it to the fuselage using two screws. I then made and attached the flexible-cable tail-feather braces. All of the necessary brackets, nuts, bolts and washers were provided.

The landing gear is factory-assembled and is attached to the fuselage with the supplied hardware. It's very scale looking.

RADIO INSTALLATION

With the Cub essentially complete, I installed the pushrods and radio equipment. The pushrods are made out of hardwood dowels to which you attach wire ends that are held in place with heat-shrink tubes. The pushrod lengths aren't given in the instructions, so you're on your own to measure the distance from the servo to the control horn. The elevator pushrod has two threaded wires at the elevator end (one for each elevator half), and it's a little difficult to install. Here's how I did it: I bent the wires to the approximate angles and placed a rubber band around the ends about 1 inch from the ends to hold the wires about ½ inch apart. I inserted the pushrod into the fuselage and fed a wire through one of the slots at the rear of the fuselage. I placed a brass tube over the now protruding wire end, cut the rubber band and slid the tube farther onto the first wire to prevent it from snapping back into the fuselage. This released the other wire and allowed me to feed it through the slot on the other side of the fuselage. The brass tube held the first wire in place while the second was inserted through its slot. I then removed the brass tube and attached the clevises.

I mounted three standard servos in the servo tray and hooked up the rudder and elevator pushrods. Because I don't like to use EZ-type connectors on primary controls, I used L-bends with snapper-keepers instead of the provided connectors. The throttle pushrod is a solid wire in a plastic tube. I wrapped the receiver and battery in foam and placed them in front of the servo tray, following the instructions.

FINISHING TOUCHES

The final step is to install the windows and windshield. To improve the Cub's scale appearance, I added diagonal braces and wing fairings to the front of the cabin, and I glued the windshield in place instead of attaching it with screws. The instructions call for the cabin floor to be screwed into place, but there is simply no way to do this. Since the cabin door is already screwed into place, I put grooved rails inside the cabin to hold the floor without screws. I added a civilian DGA pilot figure, and the Cub was ready for takeoff.

CONCLUSION

I found The World Models Piper J-3 Cub to be a well-made ARF that went together easily and has a very neat appearance. It's manufactured with precision and includes some well-thought-out features that make it a pleasure to build. If you want to get a big plane into the air quickly for some leisurely flying, The World Models ¼-scale Piper J-3 Cub may be just what you're looking for. ✈

***DGA Designs** (716) 396-5964; dgadesigns.com.*

***Futaba Corp. of America;** distributed by Great Planes Model Distributors Co. (800) 682-8948; futaba-rc.com.*

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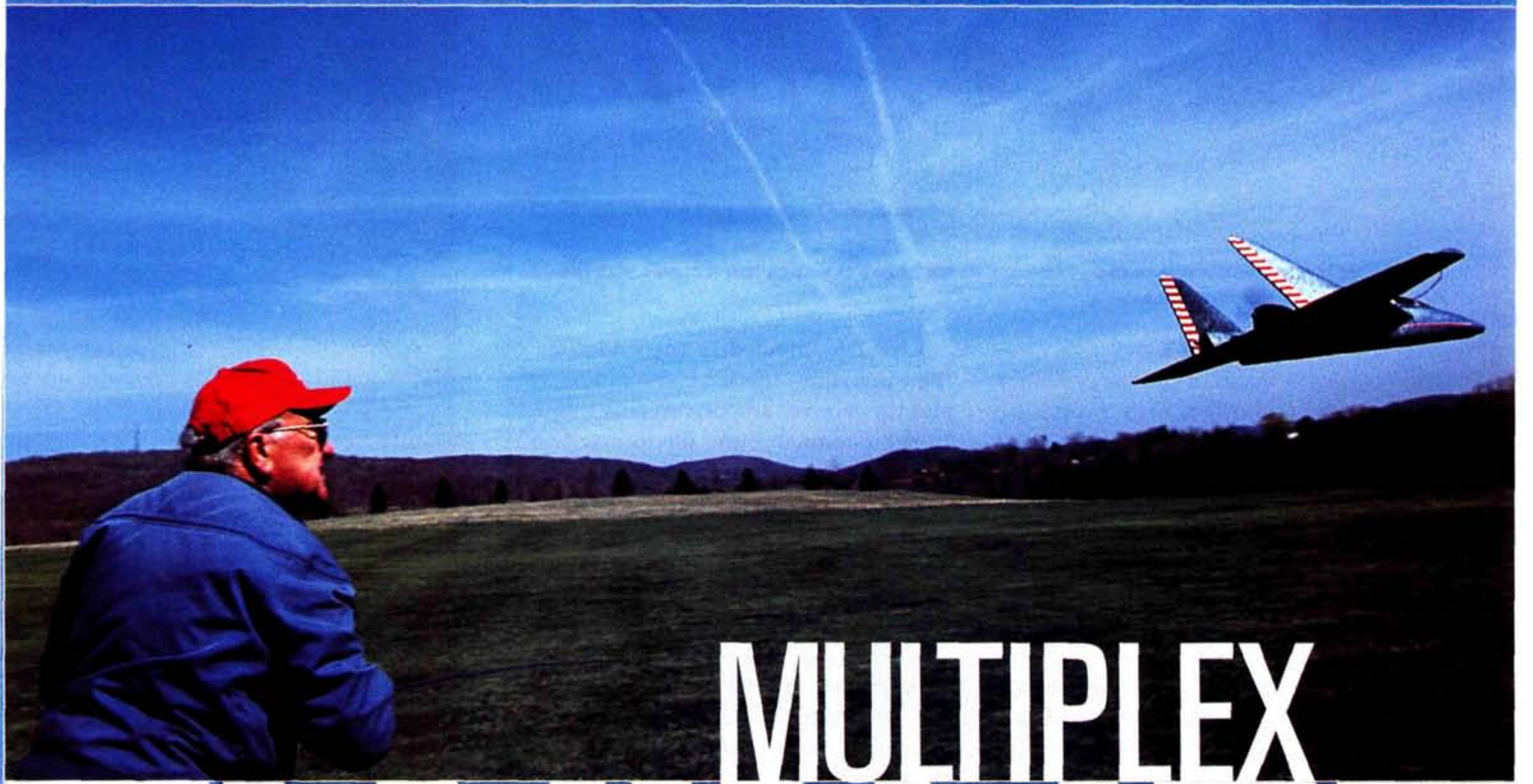
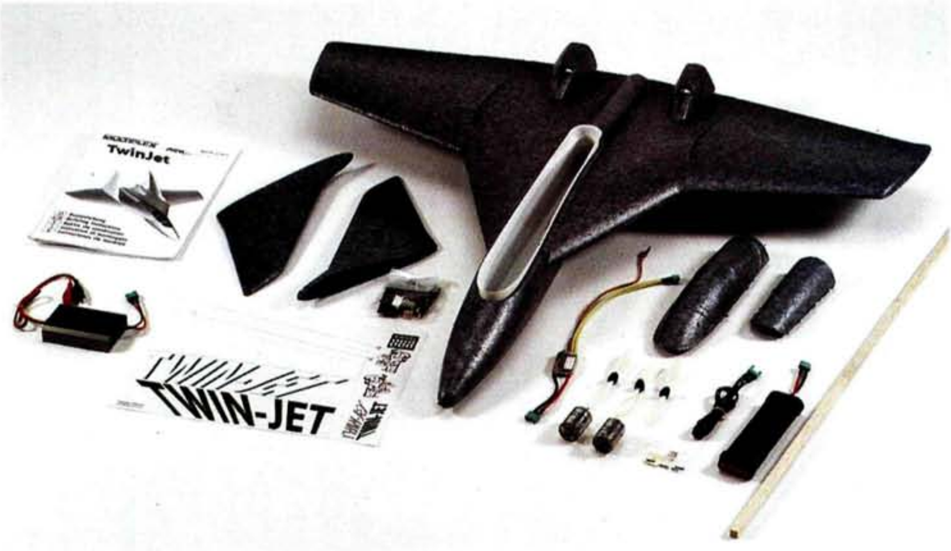
Futuristic electric jet action



MULTIPLEX TWINJET

by Jim Onorato

Not much compares with the excitement of flying a jet, unless it's a twin jet! If you're looking for excellent performance from a model that just looks right and flies right, keep reading. Distributed in the U.S. by Hitec RCD, the Multiplex TwinJet gives you that real jet feeling. That it's electric is a bonus: one of the reasons I like to fly multi-motor planes is their inherent reliability: rarely does one electric motor quit while the other is still running.



The TwinJet is made of durable particle foam and doesn't need to be painted; it comes with two Permax motors, propellers and cables.

SPECIFICATIONS

NAME: TwinJet

MANUFACTURER: Multiplex

DISTRIBUTOR: Hitec RCD

TYPE: electric sport ARF

WINGSPAN: 35.8 in.

WING AREA: 395 sq. in.

WEIGHT: 32 oz.

WING LOADING: 11.7 oz./sq. ft.

LENGTH: 31.6 in.

RADIO USED: Futaba FP-7UAF transmitter, Hitec 555 micro receiver, two Multiplex MS-X2 servos and a Multiplex Pico-Control 400 Duo ESC

MOTORS: two direct-drive Permax 400s (included)

BATTERY USED: 7-cell, 1400 and 2000mAh Ni-Cd packs

FLIGHT DURATION: 5 to 12 minutes, depending on battery pack used

PRICE: $110

FEATURES: durable particle foam construction; no painting required; two Permax 400 motors, propellers and cables included.

COMMENTS: the TwinJet is fast and easy to assemble and, in the air, it gives you that real jet feeling. It looks right and flies right. The twin Permax 400 motors give the TwinJet enough "zip" to make it exciting!

HITS
- Excellent flight performance.
- Easy assembly.
- Good overall appearance.

MISSES
- None.

IN THE BOX

The TwinJet is made of blue/gray Elapor particle foam and comes with a complete power set consisting of two Permax 400 motors, two propellers and connecting cables. You need to supply the radio equipment, battery pack and speed control. Elapor is a high-tech particle foam (polypropylene) that is tough enough to resist crash damage, and, unlike Styrofoam, it can be glued with CA-type adhesives (in fact, you shouldn't use white glue or epoxy). The TwinJet has only six major parts: the wing with main fuselage section, the fuselage nose section, two fins, the fuselage top decking and the canopy. The TwinJet does not have to be painted, and it can be assembled in just a few hours. It uses two servos for aileron/elevator (elevon) control; if you don't have a computer radio, you'll need a separate delta mixer. The assembly manual includes a large sheet of numbered illustrations that correspond with each assembly step. The illustrations also identify every part by number. TwinJet decals are included, and Multiplex offers three optional national decal sets in black/red/yellow, green/white/red and red/white/blue.

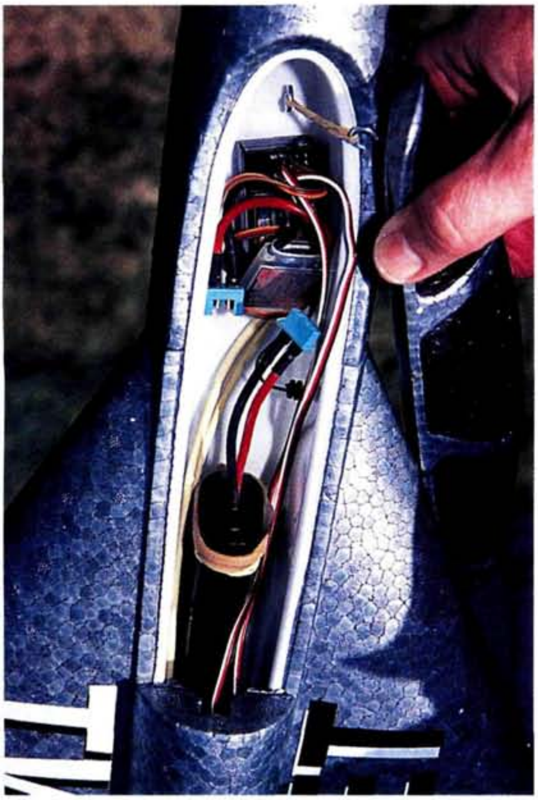
WING ASSEMBLY

After I had smoothed the rough edges of the molded-foam components, I glued the nose to the main fuselage section. Then I trimmed the vacuum-formed plastic liner and test-fit it in the fuselage to make sure that the canopy and top decking would close properly. I also cut an opening in the rear of the liner for the wiring that I would install later. When I was satisfied with the fit, I glued the liner into place with medium CA.

Channels molded in the underside of the wings allow the servo and motor wires and the receiver antenna to pass through. I used a pointed round file to make holes in the sides of the fuselage and extend the channels. The TwinJet's flat-bottom wing is curved slightly upward at the trailing edge. The elevons are molded as integral parts of the wing, which has V-channels molded in at the hinge lines. For production reasons and to prevent it from being damaged in shipping, both elevons are supplied with their ends still attached to the wing. Using a razor saw, I cut through the elevon at the root end; then I used a sharp hobby knife to free the tip end. Then, while holding the elevons in their fully deflected positions, I reinforced the hinge by applying a strip of clear vinyl tape to the top of the wing along the entire length of the elevon hinge line. Next, I attached the pushrod connectors to the control horns and glued the horns into the recesses in the elevons.

The TwinJet's wing has molded-in pockets for the elevon servos. Although it is designed for Multiplex MS-X2 servos, any microservo should be acceptable, but you might have to enlarge the pockets to fit other servos properly. I threaded the servo extensions from inside the fuselage, through the holes I had made and along the channels molded in the wing; then I soldered them directly to the elevon servos. Instead of gluing them, as called for in the manual, I used double-sided tape to hold the servos in place. Once the servos are in place, you cannot adjust the servo arms, so be sure they are centered electronically first! When everything was in place, I applied clear vinyl tape over the top of the channels to keep the wires from falling out. I connected the servos to the elevon control horns with the preformed wire pushrods included with the kit.

Note the molded-in pockets for the elevon servos and the channels for the servo wires—a neat, simple installation.



The battery is held in place with a rubber band that's attached to a screw hook.

MOTOR INSTALLATION

I routed the motor wires from the inside of the fuselage in the same way as I did for the elevon servo wires: along the molded channels and to the motor pods. I soldered the power wires to the motor terminals along with the provided capacitors. The motors are required to operate in "pusher" mode on this model, so they must be connected with reverse polarity to make them run backwards, i.e., red to black and black to red. You'll also need to turn the propellers around in the spinner so the plain face of each propeller faces the motor. I glued the motors into the pods using a few drops of medium CA, then I covered the wire channels with clear vinyl tape. I attached each propeller to its motor shaft using a tiny drop of 5-minute epoxy (do not use CA for this step!).

I glued the fuselage top decking into place with medium CA, then I prepared the canopy section. The canopy is keyed into the fuselage top decking at the rear and is held in place at the front by a rubber band attached to two screw hooks. I used black marker to color the windshield area of the canopy. A ½-inch-square strip of balsa that fits into a molded channel on the underside of the fuselage strengthens the fuselage and serves as a landing skid; before you glue this into place, you'll have to sand off a projection left after the molding process from inside the channel. The final assembly step was the installation of the fins, which I glued into place using medium CA.

RADIO EQUIPMENT

I used two Multiplex MS-X2 microservos, a Multiplex Pico-Control 400 Duo speed control with BEC and a Hitec 555 micro receiver. The TwinJet is made to accept low-cost, 7-cell battery packs ranging from 1400mAh Ni-Cds to 3000mAh NiMHs. I used 1400 and 2000mAh Ni-Cd packs. I attached the receiver and ESC to the liner in the forward part of the fuselage using hook-and-loop fastener; then I ran the receiver antenna out of the fuselage and along the molded channel on the underside of the wing and covered it with clear vinyl tape. The battery pack goes in the rear of the fuselage with its front end resting on an angled plastic ramp; it's held in place by a rubber band attached to a screw hook. (To hold the battery pack more securely, I removed the plastic ramp and replaced it with a balsa saddle.) Marks that have been molded into the underside of the wing roots indicate where the model's CG should be; you can vary the battery position slightly to get the model to balance properly. After I had applied the black-and-white TwinJet decals and the optional red, white and blue decals, the TwinJet was finished and ready to fly.

CONCLUSION

Multiplex claims that this is a tough plane with reduced crash-damage risk and I agree. My TwinJet has survived a midair and a trip through the trees with minimal damage. I really enjoy this plane! If you're looking for a change of pace and want some real excitement, I highly recommend the Multiplex TwinJet. It is well-made, easy to assemble, very durable and looks and sounds great in the air. You can't ask for much more than that! ✈

Futaba Corp. of America*; distributed by Great Planes Model Distributors Co., (800) 682-8948; futaba-rc.com.*

Multiplex*; distributed by Hitec RCD (858) 748-6948; hitecrcd.com.*

FLIGHT PERFORMANCE

TAKEOFF AND LANDING

The TwinJet is easy to hand-launch, but it requires a powerful throw with its nose angled upward at about 10 degrees to give it sufficient ground clearance while it picks up speed. I usually hand-launch with some up-trim in the elevons, then I adjust the trim so that the model climbs gently at full throttle. If you do this, make sure that you readjust the trim before your next hand-launch.

The TwinJet glides nicely and makes smooth belly landings on grass. I keep some power on for the final approach and kill the motor just as the plane crosses the runway threshold. Then I just keep it level and let it settle in on its own. It usually slides along the grass for several feet before it comes to rest.

LOW-SPEED PERFORMANCE

The TwinJet flies very well at slow speed and remains responsive to control input. You simply can't stall this plane. Well, I guess when you get it to stop flying forward and it finally drops out of the sky, you could call that a stall, but it is always straight ahead. With a wing loading of less than 12 ounces per square foot, this plane can "float" around for a long time with minimal power input.

HIGH-SPEED PERFORMANCE

This is where the TwinJet really shines. It has a real, jet-like feel, and when it streaks across the field coming out of a dive, its two motors make an awesome sound. Low, high-speed passes are a blast.

AEROBATICS

Without rudder control, the TwinJet's aerobatic maneuvers are somewhat limited, but it does extremely fast axial rolls and large sweeping loops. It also flies well inverted.

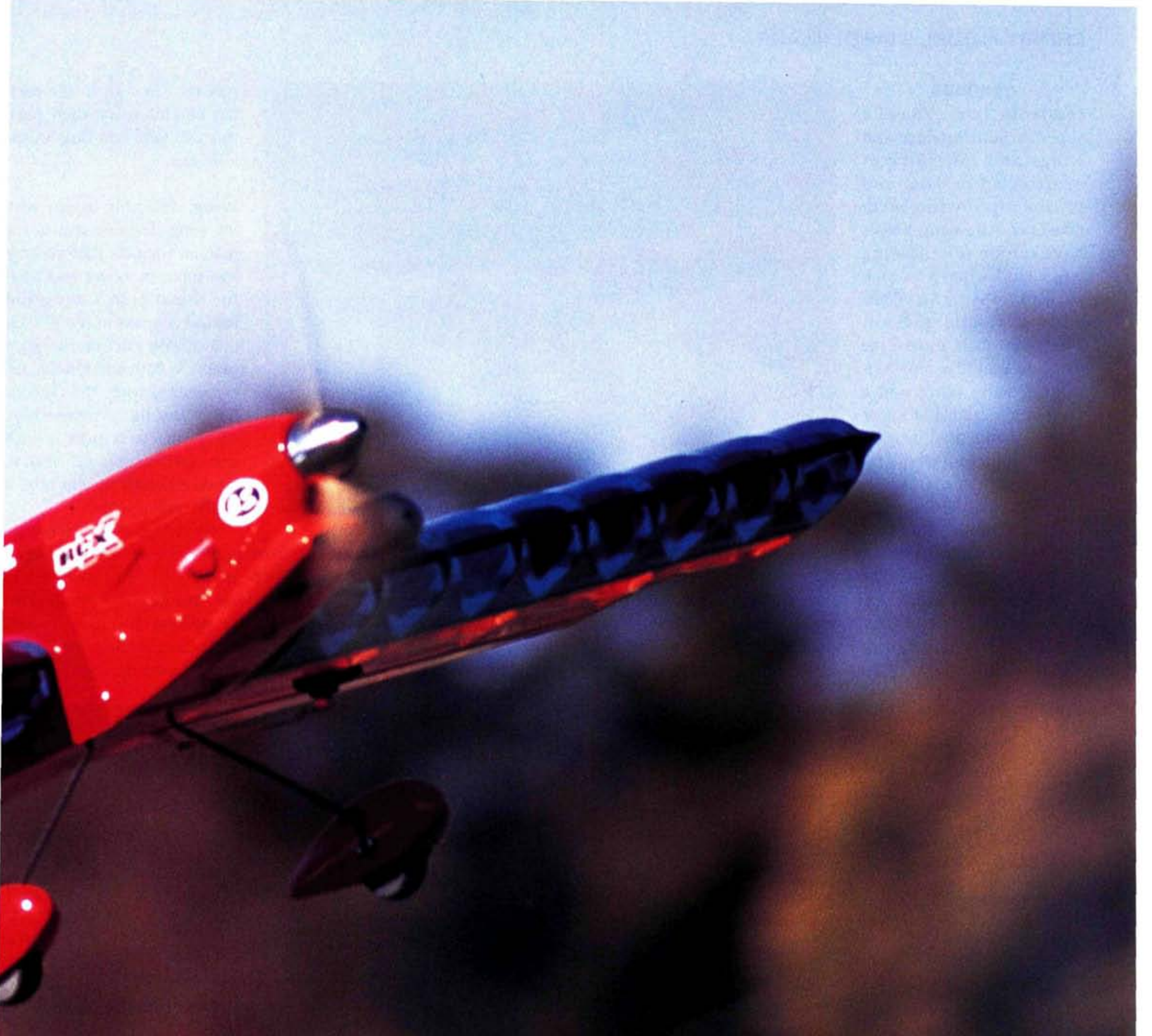
Esprit Model Diabolic

.60-size 3D fun-fly ARF

by Roger Post Jr.

The Esprit Diabolic is, quite honestly, the finest ARF I have seen to date. Manufactured by Topmodel CZ in the Czech Republic, the Diabolic is superbly built and covered, and it features an extremely well-engineered 3D design that is sure to appeal to pilots at every level—from weekend fliers to top-level competitors. After one look at the Diabolic, I knew Esprit had a winner on its hands.

PHOTOS BY WALTER SIDAS



SPECIFICATIONS

MODEL: Diabolic

MANUFACTURER: Topmodel CZ

DISTRIBUTOR: Esprit Model

TYPE: 3D fun-fly ARF

WINGSPAN: 61.5 in.

WING AREA: 1,085 sq. in.

WEIGHT: 7 lb., 4.48 oz.

WING LOADING: 15.46 oz./sq. ft.

LENGTH: 63 in.

ENGINE REQ'D: .60 2-stroke or .90 4-stroke

ENGINE USED: O.S. Max FX .61 2-stroke

PROP USED: Zinger 14x4 wood

RADIO REQ'D: 4-channel w/5 servos (elevator, rudder, throttle and ailerons)

RADIO USED: JR 388 w/two JR NES-4131, two JR NES-4000 and one JR NES-517 servos

FUEL USED: Hangar 9 2-stroke 15-percent nitro

PRICE: $339

FEATURES: lightweight balsa, ply and polystyrene construction with Oracover covering; carbon-fiber leading edges; a removable piano-wire undercarriage; epoxy fiberglass wheel pants and cowl with red gelcoat; large, transparent PVC canopy; ball-bearing stabilator-tilt mechanism; top-quality hardware, illustrated assembly manual and decals included.

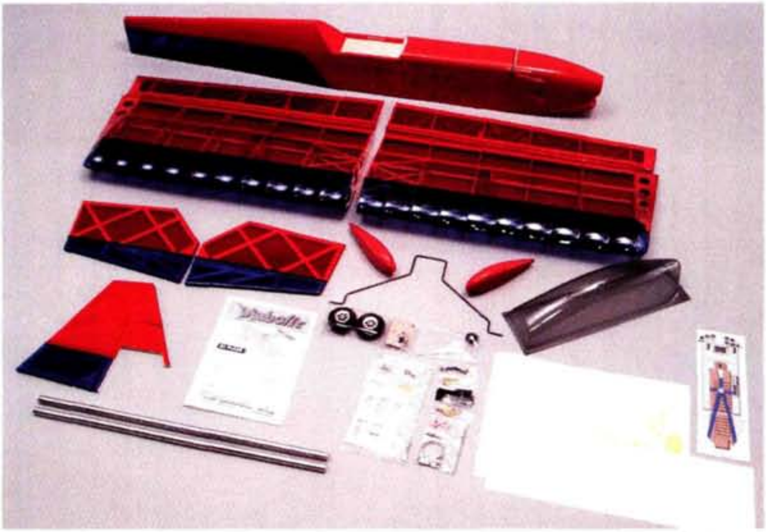
COMMENTS: the Diabolic is a superbly manufactured ARF. It is fairly easy to assemble, but a lack of written instructions necessitates some thinking ahead. It flies beautifully at the field and looks great in the air. Overall, it's a winner!

HITS
- High-quality construction.
- Nicely covered.
- Excellent flight performance.

MISSES
- Lack of written instructions.

CONTENTS

Inside the box, I found a superbly built fuselage and wings and tail surfaces constructed of balsa and ply and expertly covered in Oracover. The wing halves have carbon-fiber leading edges, and when you look at the ribs, the CNC milling is quite obvious. The topnotch hardware package includes two aluminum wing tubes and a carbon-fiber stabilator joiner with a double-ball-bearing stabilator-tilt mechanism, as well as almost everything else required to complete the model except a motor mount, a fuel tank and a spinner. Completing the kit were a nicely painted fiberglass cowl and wheel pants and a large, transparent PVC canopy. Decals and an illustrated instruction manual are also included.



The construction and covering quality, as well as the supplied hardware, is topnotch. You would be hard-pressed to find an ARF that's built and covered better.

ASSEMBLY

Because there are no written instructions, it's essential to have a good working knowledge of how to construct a model from drawings. Thoroughly study the manual's illustrations before you start the process. Then go to the parts list and identify each part; this will save you time in the long run.

Wing. Assembly begins with the wing. The first step in the manual suggests that you cut and splice in longer lead wires for the aileron servos, but instead, I opted to use JR's 12-inch aileron extensions—much easier! As with any fun-fly, 3D-constructed wing, the Diabolic has a very thick cross-section, so be sure to handle it with care; a strong grip will crush it. I recommend that you hold it by the trailing edge.

Next, I cut holes in the wing's covering for the aileron servos and then glued the ailerons into place using 5-minute epoxy. This glue is recommended throughout the manual, and it works well for this model. To attach the wings, I cut away the fuselage covering for the wing

FLIGHT PERFORMANCE

At the field, I carefully assembled the model, balanced it (with the tank empty) and double-checked the controls; I set the rates to low for takeoff. I leaned out the low-end needle valve and then taxied to the takeoff point. The Diabolic taxies easily, but I recommend removing the wheel pants on rough fields.

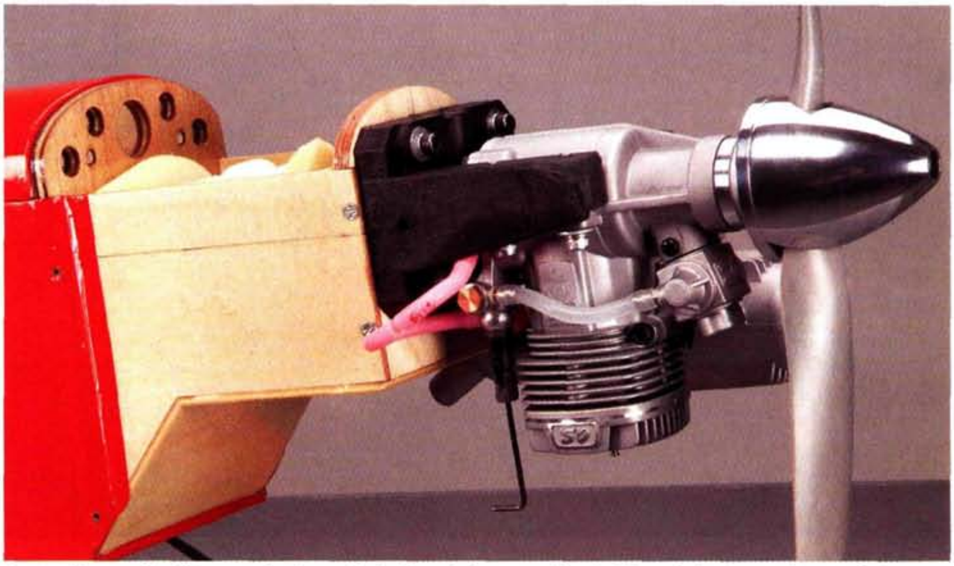
TAKEOFF AND LANDING

With a gradual increase in power and a bit of right rudder, the Diabolic uses about 50 to 60 feet of runway for the takeoff roll. Apply a bit of backpressure, and the model easily rotates from the runway. Its thick wing inhibits high-speed flight, so don't expect the Diabolic to blast off once it

The Diabolic is designed to fly lazily around the field while performing outrageous 3D maneuvers. It is by no means a speed demon, and it shouldn't be flown as one.

joiners, hooks and aileron servo wires, slid the two aluminum joiner tubes through the fuselage (leaving 10³⁄₁₆ inches on both sides) and mounted the wings on the joiner tubes. With the wings mounted, I determined the locations of the two wing hooks by tracing the holes from inside the fuselage onto the wing ribs. I then used a ³⁄₃₂-inch drill bit to make the necessary holes in the center of the traced circles, installed the hooks and dripped some thin CA into the holes to secure them in place. At the field, run thick rubber bands through the fuselage and attach them to the hooks on both sides to hold the wing securely in place.

Install the aileron servos next, but be sure to note the servos' tops in relation to the wing's bottom. The illustration in the manual shows the servos' brass eyelets being inserted into the rubber grommets from the top, but this should be done from the bottom. I added ³⁄₁₆-inch-square hard-balsa rails to the front and back of each servo tray to provide the glue with a little more surface to adhere to. When the control linkages have been hooked up, the wings are complete.



To get the cowl to fit properly, I rounded off and shortened both sides of the forward part of the Great Planes' two-piece motor mount. The Great Planes' two-inch aluminum spinner aligns perfectly with the cowl's nose ring. Note the screws that hold the firewall in place—a great safety feature!

Engine installation. The O.S. Max FX .61 engine I chose is a perfect match for the Diabolic. Start by mounting the engine on your mount of choice, and then determine its location on the firewall using the method shown. Next, I drilled holes in the firewall for the fuel tank and motor-mounting bolts. Do not drill a hole for the

leaves the ground. It has very docile characteristics on low rates; even a novice pilot can handle the takeoff. The climb-out requires a bit of right rudder to keep the tracking straight. For the 3D pilot, full blast on the throttle, right rudder as required and a quick pull on the stick (high rates) will get the model off the ground in about 20 feet (short grass) and into a hover quite rapidly.

To land the Diabolic, use the standard approach (downwind, base leg, final), and gradually reduce the throttle while adding some up-trim. The approach can be shortened considerably, as the Diabolic has a very low landing speed. On final, reduce the power to idle, and gently flare it into the grass. For an airplane that can twist itself into a knot in flight, it certainly is easy to land.

LOW-SPEED PERFORMANCE

With its thick, symmetrical airfoil, the Diabolic is at its best at low speeds. If you couple the flaps to the stabilator, you can get the Diabolic to practically float in the air. Whether on high or low rates, the large control surfaces provide authoritative control at low speed, and the stall just mushes forward with a slight drop. To recover, release the stabilator input and add a little power.

HIGH-SPEED PERFORMANCE

The Diabolic is designed to be a low-altitude, right-in-front-of-you type of model that excels in 3D maneuvers, but its thick airfoil does not allow for high-speed flight. With the stabilator on high rates, high-speed flight is specifically discouraged; structural damage could occur if you pull too hard on the stick.

AEROBATICS

The Diabolic can easily perform the standard loops, rolls, snap rolls, spins, Cuban-8s, etc., but its real strength is low-level, low-speed 3D maneuvers. With a stabilator throw of 85 degrees up and down, this airplane can stop on a dime, flip over practically within its own length and perform some incredible tumbling maneuvers. The manual explains a maneuver called the "Kulbuto" plunge, in which the model makes 90-degree turns in a vertical plane using only the stabilator and some power. With 35 degrees of throw (high rate), its large ailerons give it a fairly high roll rate and will initiate a torque roll from a hovering position. The rudder has 45 degrees of throw (high rate), and its large area allows the Diabolic to easily perform knife-edge and snap maneuvers.

The manual provides recommended exponential rates, but I found the 80-percent exponential on the stabilator's low-rate setting to be too much, so I reduced it to 50 percent. The others were a good place to start.

The O.S. Max FX .61 engine is a perfect match for the Diabolic's airframe. The only adjustment required was to lean out the low-end needle.

throttle linkage until after you've mounted the engine; then, ensure that your motor has the required 1 degree of downthrust and 1 degree of right thrust, as shown. Some thin washers helped me achieve this.

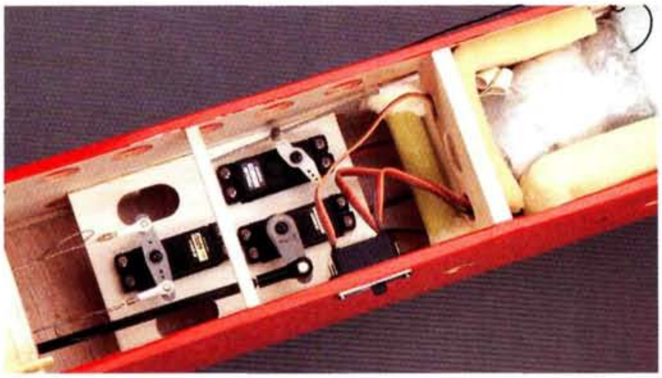
Control linkages. I assembled the stabilator's control rod as shown in the drawings. It should be noted that there is a different length of threaded rod at each end: 25mm where it connects to the stabilator horn and 15mm where it connects to the servo arm. I opened up the holes in the aft fuselage for the polyurethane bearing housings and drilled the holes in the tail post for the ball driver per the drawings. Because the original holes were too small, I used an ⅛-inch drill bit to widen the holes for the stabilator's limit-stop bar.

Before you place the stabilator control rod in the fuselage, check the fit of the carbon-fiber stabilator joiner in the square opening in the stabilator horn. If necessary, file the opening to achieve a good fit.

Install the stabilator's pushrod and joiner along with the polyurethane housings and ball bearings as described. Don't glue anything into place until you're sure that everything moves smoothly without binding. The drawings recommend that you use epoxy to secure the polyurethane housings and ball bearings in place, but because I didn't want to risk getting epoxy in the bearings, I let the stabilator halves hold them in place instead. Install the limit-stop bar, and then apply the epoxy to its outer areas to hold it in place.

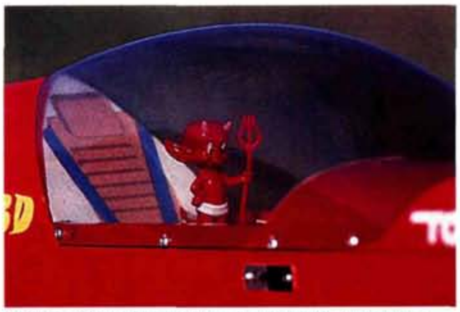
I next drilled the holes in the fuselage's aft section (one per side) for the pull/pull rudder cables and glued the plastic cable-housings into place. I ran the cables into the fuselage from these holes and temporarily secured them at each end with some masking tape. I then attached the vertical fin, tailwheel and rudder (in that order), as well as the rudder control horns. Last, I attached the pull/pull cables to the horns.

Radio installation. Before you install the servo tray, place the stabilator halves on their joiner, install the three servos in the tray, and ensure that the stabilator's servo arm is in neutral. Then set the stabilator to a level attitude and temporarily tape it into place. Doing this will help you properly position the servo tray; if it's too high, the stabilator control rod will bind against the opening in the radio compartment's aft former. As with the aileron servo trays, I added 3⁄16-inch-square hard-balsa rails to the fore and aft sides of the servo tray. When you're sure of the correct location, install the tray and the rest of the radio equipment, and then hook up the rudder cables, stabilator control rod and throttle linkage.



The radio compartment has plenty of room for your standard-size radio. For balance purposes, the Hobbico HydriMax Ultra Sanyo 1450 NiMH, 6V flat battery pack is under the receiver.

Install the fuselage hatch, its cockpit decal and the canopy as shown in the drawings. I opted not to glue the canopy into place; instead, I used eight small wood screws—four per side.



Rather than glue it into place, I attached the canopy with eight small wood screws, and it's a good thing I did. The pilot figure came loose, and I had to reattach the "little devil" to the cockpit floor.

Mount the radio gear as shown, and then install the fuel tank. Next, cut the required holes in the cowl and attach it with five wood screws, as shown in the drawings. To complete the nose section, install the fuel lines, propeller and spinner. A Great Planes 2-inch aluminum spinner works perfectly here.

FINAL ASSEMBLY

The next step is to attach the stabilator halves to the joiner with screws and washers. It can be very tedious to line up and drill the holes in the stabilator halves to match the pre-drilled holes in the joiner, so take your time. It's most important to ensure that the joiner stays centered, with equal amounts protruding from each side of the fuselage. Also, make sure that the stabilator's horn, with attached ball joint and clevis, does not bind on the inside structure.

Last, I balanced the model using the manual's recommended balance point.

CONCLUSION

The Diabolic's total assembly time shouldn't comprise more than a few full days of work (if you have that kind of time). Pick one up on Monday, turn off the phone, ignore your email, and before the weekend rolls around, you'll be ready to fly your Diabolic. Its quality is outstanding, and it sure is a good-looking model—especially in the air! ✈

Esprit Model *(321) 729-4287; espritmodel.com.*
Great Planes Model Distributors Co. *(800) 682-8948; greatplanes.com.*
Hangar 9; *distributed by Horizon Hobby Inc.*
Hobbico; *distributed by Great Planes; hobbico.com.*
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JR; *distributed by Horizon Hobby Inc.*
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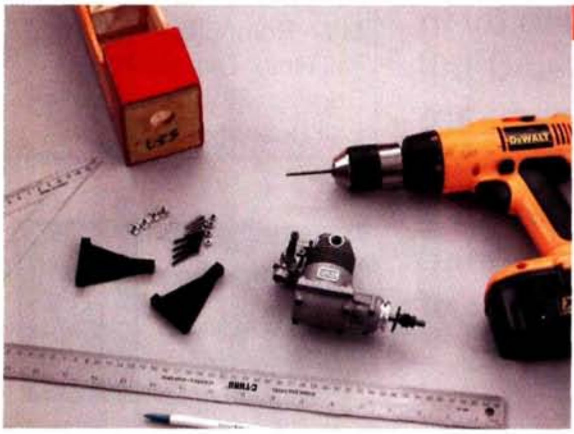
Easy engine installation

Accurate mounting is as easy as 1-2-3!

by Erick Royer

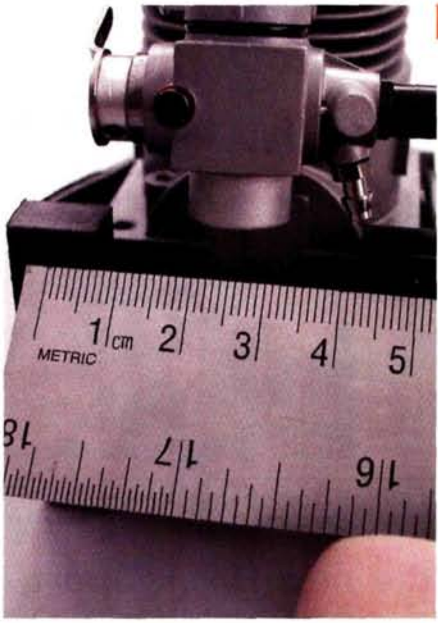
Correctly installing an RC engine mount and engine is one of the most important steps when you assemble a model plane, whether it's almost ready to fly (ARF) or scratch-built. Most ARF model kits come with engine mounts, and though some models come with the mounting holes already drilled in the firewall and with blind nuts installed for the engine mount, others require that you mark and then drill the holes in the firewall and the mounting rails. This critical process is actually very simple when you take it step by step; here, I show how I installed an RCV .58 4-stroke in a Model Tech Magic ARF. The steps to follow will be the same for a 2-stroke.



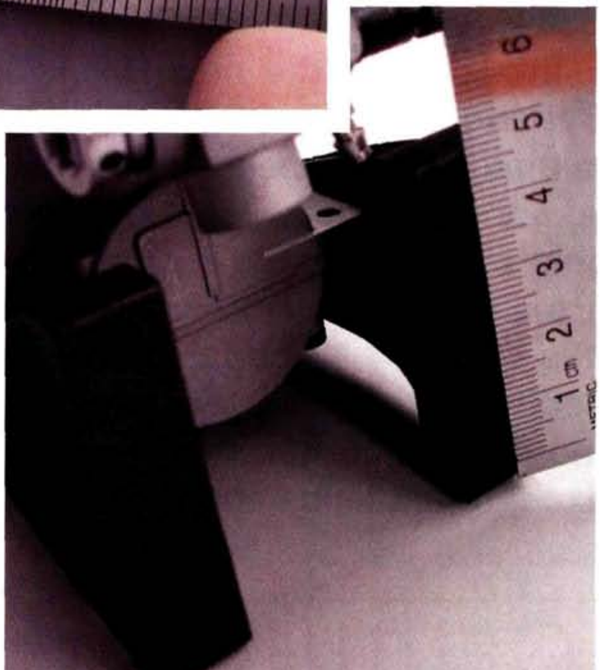
1 First, you'll need an engine, suitable tools, a mount, mounting hardware (the nuts, bolts and blind nuts that are included in many kits), a drill (and drill bits to match the bolt sizes specified in the instructions), a ruler, a pen or pencil, thin and thick CA and a triangle. I also suggest that you secure the bolts with thread-lock compound to prevent them from vibrating loose.

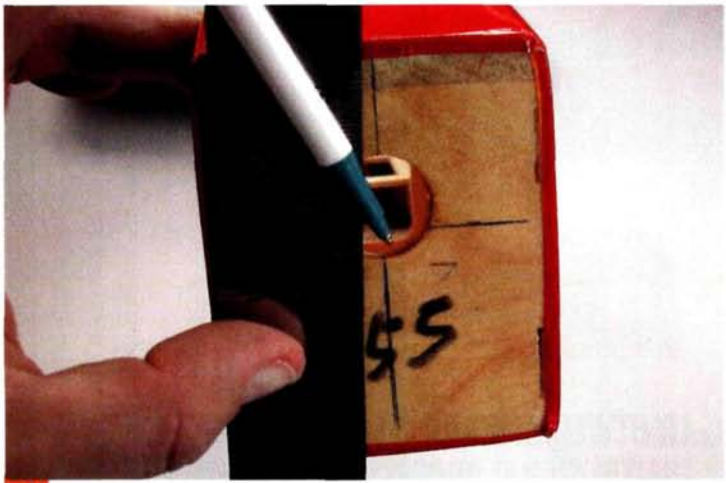
I use a Great Planes Dead Center Engine Mount Locator to determine and mark the correct positions for the engine-mounting holes. This simple tool makes it easy to mark the holes' positions correctly every time.

2 First, temporarily attach the engine to the mounting rails with a few drops of thin CA. Engines come in a variety of widths, and it's easier to measure the distances between the holes when the engine is temporarily secured to the rails.



3 Measure the distance between the holes in the left and right mounting rails, and then measure the distance between the holes on each end of each mounting rail. Note these measurements, and then lightly tap the engine to break it free of the mounting rails.

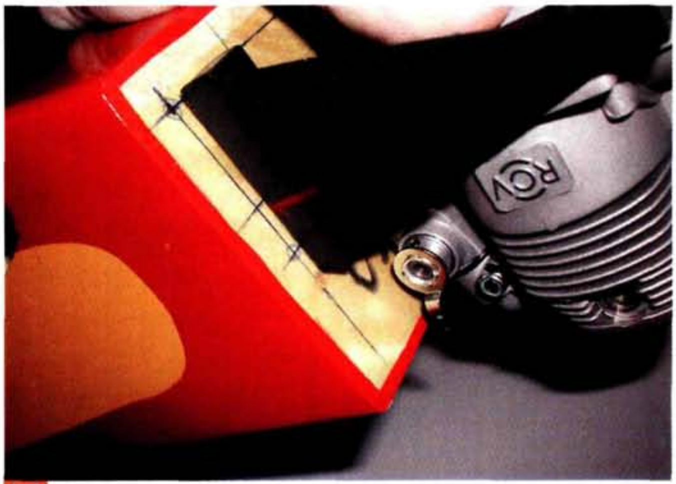




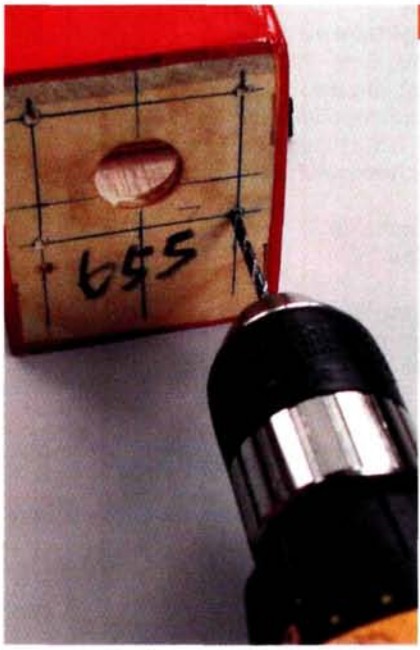
4 Refer to your instructions for the positions of the firewall's vertical and horizontal reference lines. In some ARFs, right thrust has been built into the firewall, so the vertical reference line should be offset slightly to one side to account for this.

5 Depending on your plane, you may have to mount the engine upright, inverted, sideways, or at a 45-degree angle. Refer to the instructions to find which way is best for your model. For a cleaner appearance, I decided to mount my RCV engine inverted. Divide the distance between the left and right mounting rails by two. Here, the distance was 52 millimeters, so I made a mark 26 millimeters to the left and right of the vertical reference line on the firewall. Do this above and below the horizontal centerline, and use a straightedge and a pencil to connect the marks.

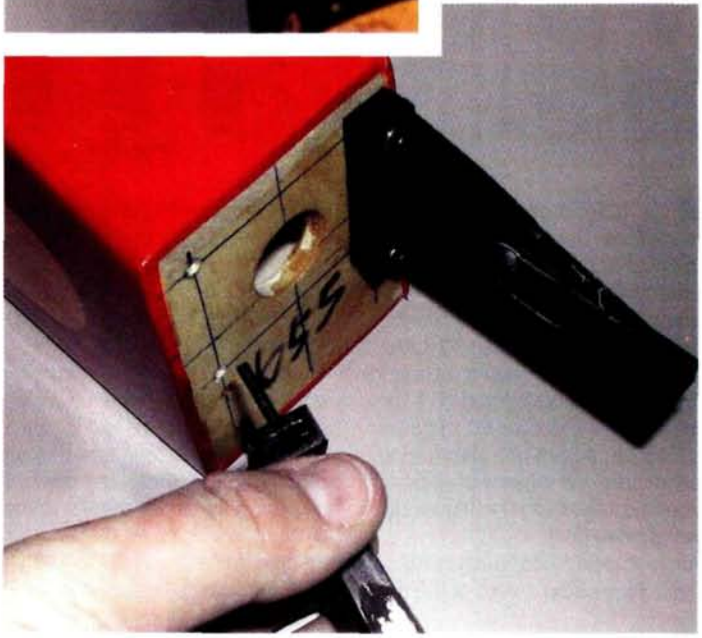
6 On planes such as the Magic, you'll need to center the crankshaft on the horizontal centerline. Using a ruler, I marked the back of each mounting rail to indicate the center of the prop shaft.

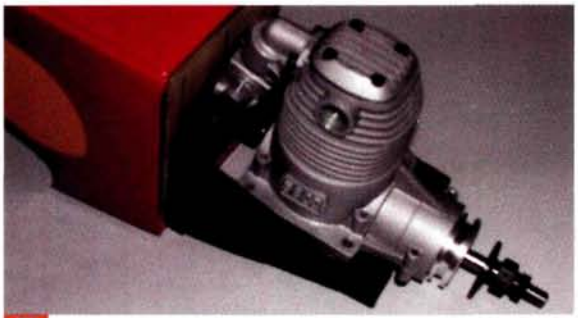


7 To correctly position the engine, I had to offset the mount toward the top of the firewall. The distance between the holes in each mounting rail was 38 millimeters. I determined that the top holes should be 26 millimeters above and the bottom holes 12mm below the horizontal centerline. Draw a line between the upper marks and the lower marks to make two new horizontal reference lines.

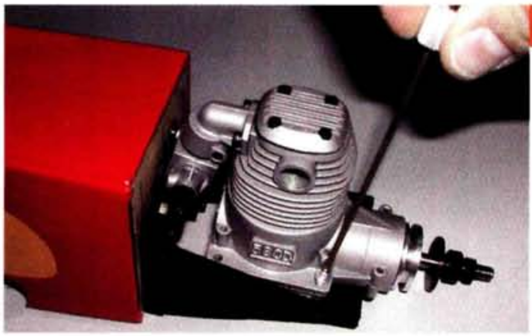


8 Using a drill bit of the proper size, drill a hole (a total of four) where the lines intersect, then attach the mount to the firewall with your bolts. Install the blind nuts on the rear of the firewall, using the mounting bolts to seat them. Add a few drops of thick CA to the inside face of each blind nut to ensure that they'll remain in place if you ever need to remove the engine mount.

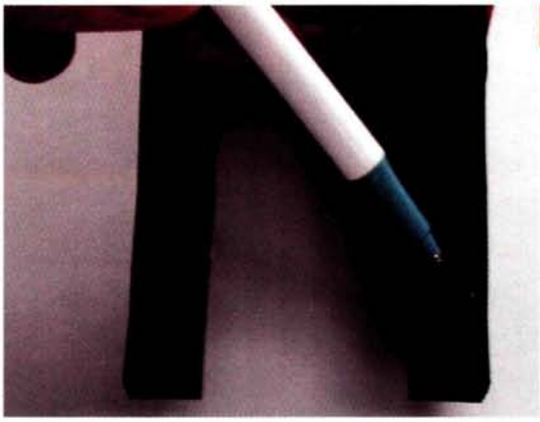




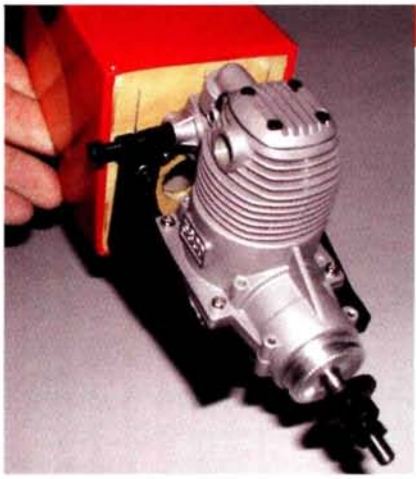
9 Place the engine on the mount at the correct distance from the firewall, as indicated in the model's instructions. For models that have a cowl, be sure to leave at least an ⅛-inch clearance between the spinner backplate and the cowl. For planes such as the Magic, which doesn't have a cowl, you can position the engine to balance the model (without adding weight). I balanced the model before I marked the mounting holes, and I determined that I'd have to mount the engine as far aft on the rails as possible.



10 I placed the Great Planes mount-locater in each hole of the engine mount's lugs and gave it a twist. The tool has a little 1⁄16-inch drill bit that marks pilot holes on the mount rails.



11 Having marked the pilot-holes' positions, I drilled the mounting holes with the correct drill bit and then installed the engine with the recommended hardware (add a drop of thread-lock to every nut).



12 Here, the engine is securely mounted on the Magic's firewall. There are many ways to mount engines, but these steps are useful for most installations. With the proper tools and accurate measurements (measure twice and drill once!), you'll quickly and easily have a perfectly mounted engine. ✈

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CONSTRUCTION

Miles Sparro

by Dick Allen

IMAA-legal Golden Age racer

My 26-percent-scale Miles Sparrowhawk is a high-performance, aerobatic aircraft. Its thick wing and stabilizer airfoils give the model stable, relatively slow landing approaches and excellent slow-speed characteristics. As a bonus, it can be flown at any IMAA or IMAC (Basic) event. And since the prototype first flew in 1935, it would be right at home at the annual Rhinebeck Jamboree.

The model's fuselage and wing outline are exactly to scale. It has an aerobatic airfoil, and the dihedral has been adjusted to eliminate roll coupling. The tail surfaces are slightly enlarged for improved flight characteristics. A Zenoah G-62 gives it nearly unlimited vertical climb and spirited aerobatic performance that are worthy of the full-size prototype. The model is fast, and though it has no bad habits aerodynamically, it is not a beginner's model; it requires advanced building skills.

whawk

PHOTOS BY DICK ALLEN

FLIGHT PERFORMANCE

Balance the model as indicated on the plans. The model should require little or no lead weight for balance. Check the left/right balance by picking up the plane by its engine shaft and tailwheel mount. Add weights to the lighter wingtip, if necessary. For your first flight, start with the following control-surface throws:

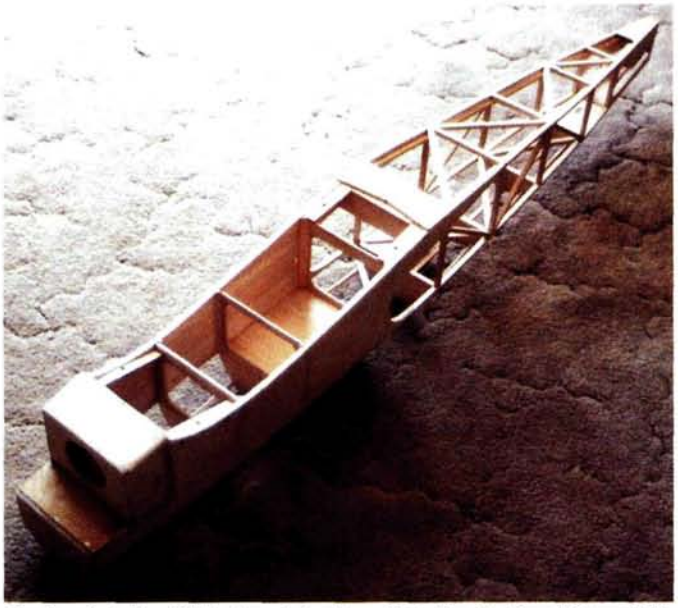
	Low rate (in.)	High rate (in.)
Elevator	Up/down ½	¾
Rudder	Right/left 2	3
Ailerons	Up/down ⅞	1⅛

I use 30- to 40-percent exponential on all of the above.

My Sparrowhawk required only slight adjustment of the aileron and elevator trim on its first flight. I use full up-elevator to "dig in" the tailwheel for the first few feet of the takeoff run. If you have the correct amount of right engine thrust, the model will track straight into the wind with little or no rudder correction. Slight up-elevator will ease it off in about 75 to 100 feet.

Inside and outside loops are graceful, and performing vertical 8s is no problem. The rudder is very effective; the model performs good stall turns with no aileron correction. Rolls and inverted flight are docile. In straight and level flight, there is no roll coupling and only slight down pitch coupling with rudder.

Slow-flight characteristics are very good. The thick, stable airfoil slows the landing approach at the point where many other aerobatic airplanes would drop out of the sky. Set up as recommended, the model will neither snap out of nor tip-stall out of a tight loop. Stalls are straight ahead, with neither wing dropping out. In light wind, I sometimes use spoilerons (up-ailerons) to increase drag for landings. I prefer full-stall, 3-point landings—even in wind.



The fuselage is a light, strong structure. Note the staggered firewall; it provides room for the engine and muffler in its narrow cowl.

FUSELAGE NOTES

The fuselage is constructed to be light and strong. Note that the staggered firewall (F1) is made of four separate pieces of ¼-inch aircraft-grade ply. For additional strength, four pieces of 3/8-inch-square (or ½-inch-triangular) basswood are screwed and glued to the firewall and side pieces. Coat the entire outer surface of the firewall with epoxy to fuelproof it. Drill a hole in the bottom of the tank compartment to allow any leaking fuel to drain out. The five top ¼-inch-square longerons from the firewall to the cockpit are made of spruce; from there back to the tail, the longerons are made of balsa. The four 5/16-inch-square corner doublers at the inside corners of the fuselage (from F5 and F6 to the tail) are glued into place after the sides have been assembled. Do not omit these; they add great strength and stiffness by increasing the glued area of the structure.

The front and rear turtle decks are covered with 3/32-inch balsa. They will be easier to bend and glue into place if you first soak them in water for 20 minutes and then tape them into place to dry overnight. Cut out a slot for the fin, and then glue the rear turtle deck into place after the stab and fin have been glued into place. Glue the front turtle-deck sheeting into place after you have installed the engine.

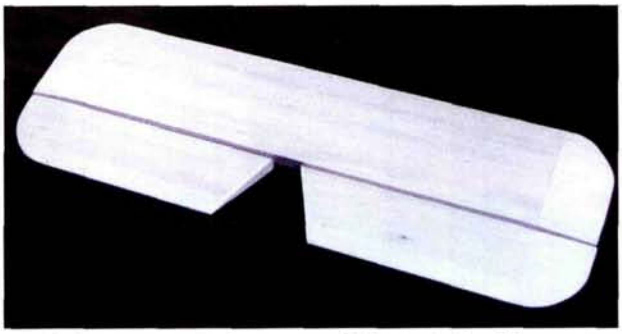
I used a Sullivan tailwheel bracket (item no. S862) rated for a 16- to 35-pound model. The large and beautiful Spitfire-like wing fillets are made after the wing has been framed up and attached to the fuselage. I used a 1/32-inch ply base sandwiched between the fuselage and the wing. I used plastic wrap to protect the upper surface of the wing, and then I formed the fillets with blocks of foam, fiberglass cloth and resin.

When the fuselage has been completed, hold the fuel tank, receiver and battery pack (wrapped in foam) in place with double-sided hook-and-loop fastener material.

TAIL FEATHERS

Since the Sparrowhawk has a relatively long tail-moment arm, it is imperative to keep the tail surfaces light. The stab airfoil is symmetrical and is covered with light 3/32-inch balsa sheet. The laminated tips shown are light, strong and elegant; but it will fly just as well with conventional, carved-balsa tips. Please don't build the tail out of a heavy slab of 3/8-inch balsa.

Build the fin as shown on the plans, and make the rudder out of the lightest piece of ½-inch balsa you can find. Reinforce its top and bottom as shown. Do not glue the tail-surface hinges into place until the stab and fin have been glued to the fuselage. When you glue the tail to the fuselage, use the wing as a reference.



The built-up stab and elevators are fully sheeted and have a symmetrical airfoil.

SPECIFICATIONS

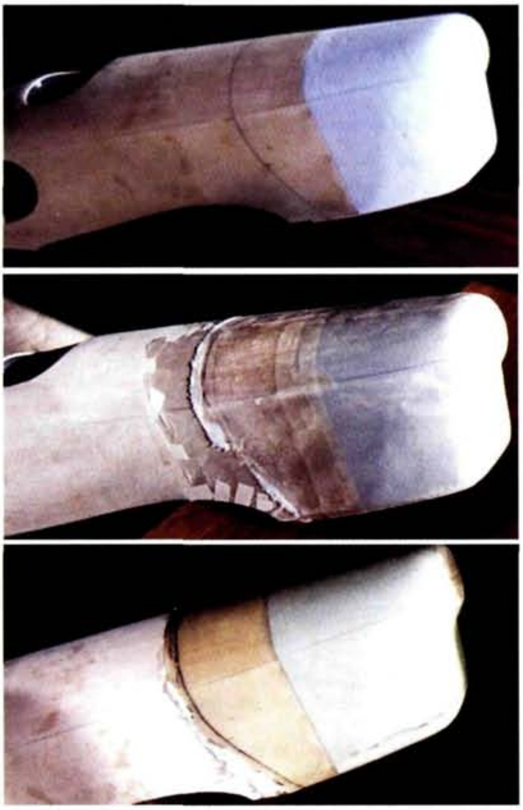
MODEL: Miles Sparrowhawk
SCALE: 26 percent
WINGSPAN: 88 in.
WING AREA: 1,440 sq. in.
WEIGHT: 20 lb.
WING LOADING: 32 oz./sq. ft.
LENGTH: 74 in.
ENGINE USED: Zenoah G-62
RADIO REQ'D: 4-channel (rudder, elevator, throttle, aileron)
PROP USED: Zinger 22x8

COMMENTS: designed by Dick Allen, this 26-percent–scale Miles Sparrowhawk uses conventional built-up balsa and plywood construction throughout. Foam is used to form the fiberglass engine cowl and the wing fillets, and they are formed directly on the model's structure. The Sparrowhawk is very aerobatic and is legal for both IMAC and IMAA giant-scale events.

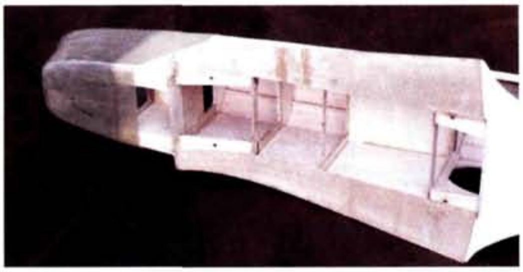
FORMING THE ENGINE COWL

The engine cowl is formed directly on the finished fuselage before it's painted. Cut two side-view templates of the cowl out of lite-ply, and use them to cut a block of blue foam to shape with a hot wire. Tack-glue the foam to the nose, cut it to shape with a sharp knife and then sand it with sanding blocks. Cover the foam and the front 6 inches of the fuselage with a layer of plastic food wrap pulled tight and taped securely into place. Use a heat gun to smooth out any wrinkles so it conforms snugly to the nose. Build up several layers of fiberglass cloth and resin over the foam and plastic wrap (use just enough resin to saturate the cloth). After the resin has cured, sand it smooth, remove the tape and plastic wrap and pull the cowl from the fuselage. Cut the aft edge of the cowl to its correct shape, as shown on the plans, and sand it smooth. It's easier to position the cowl-mounting screws before the cowl has been painted. Likewise, cut the openings for the muffler, carburetor and spark plug before you prime and paint.

For a lighter, smoother running G-62 engine that's easier to start, I had my engine modified by C.H. Ignitions Inc. The electronic-ignition system replaces the stock coils and coil-mounting lugs that would otherwise protrude through the cowl. This results in a cleaner front end. The modified engine produces more than enough power for the 19-pound Sparrowhawk. Install your engine with 2 degrees of right thrust. The four engine-mounting holes shown on the plans should give you the correct amount of right thrust and tilt.



Top: I made the engine cowl by tack-gluing foam blocks to the fuselage and carving them to shape. I built up fiberglass cloth and resin over the foam after I had covered it with plastic food wrap. Center: when the resin has cured, sand it smooth, separate it from the fuselage, and (above) remove the foam.



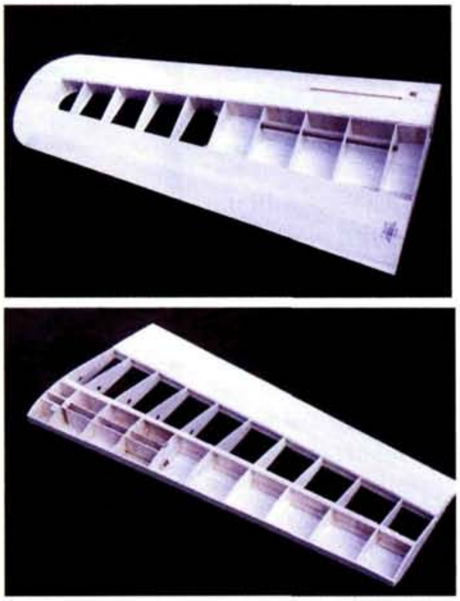
The base of the wing fillets is made of thin plywood and glued between the wing and the wing saddle.

The tops of the fillets are formed of foam and covered with fiberglass cloth and resin.

WING CONSTRUCTION

The wing airfoil is semisymmetrical and is flat from the main spar to the trailing edge on both the top and bottom. Before assembly, draw a straight centerline on all the ribs and on the back side of the sub leading edge. On a flat building surface, pin the lower trailing-edge sheeting to the plans, and draw straight lines on it where the spars will go. Now place the rear ½x¼-inch and ¼-inch-square wing spars and the ⅛x¼ aileron spar into position. Use a 48-inch piece of 3/32-inch sheet balsa near the midpoint of the ribs to support them during construction. Accurately position all the ribs on the lower trailing-edge sheet and spars; use weights to hold them down, and then glue them into place with CA. Glue on the sub leading edge after you've carefully lined it up with the centerline of each rib. Glue in all of the top wing spars and the diagonal braces in the ailerons. Glue in the ¼-inch ply plate for the aileron horns and the hard-balsa fill for the wing bolts.

Tilt the two center ribs to accommodate the dihedral. Before you glue on the top trailing-edge sheeting, make small cuts in the bottom sheeting to define where the ailerons will later be cut out of the wing assembly. Turn the wing over, weight it down, and glue in the bottom wing spars, the landing-gear mount and the bottom leading edge and center-section sheeting. Let the assembly dry overnight. When the glue has set, turn the wing over again, weight it down, and finish all the details such as wingtip, servo mount, shear webs, landing gear and front vertical wing-bolt blocks, etc. Glue in the ¼-inch-ply landing-gear fairing attachment-screw retainers. Do not glue the top center section and top leading-edge sheeting yet.



Top: each wing panel is built separately and then joined to form the completed wing. Above: here, the leading-edge sheeting and the leading edge have yet to be installed.

Build the other wing half in a similar manner, but do not cut out the ailerons until each wing-half assembly has been completed. Note that the grooved hardwood landing-gear blocks extend all the way to the center ribs, where they form the backbone of the dihedral support. They are tied together with a ¾x½-inch hardwood block that extends between the R2 ribs. A ¼-inch ply dihedral brace is then fitted between the R2 ribs and between the top of this block and

the bottom of the two ¼-inch-square adjacent top spars.

Cut the other dihedral brace out of ¼-inch ply, and fit it between the rear ¼x½-inch wing spars that run between the left and right R2 ribs. Rib R1 must be cut out to accommodate the dihedral braces. When the wing panels have been built and the dihedral braces are in place, glue on the top center section and leading-edge sheeting. Sand the front of the panels true, and glue on the leading edge. Shape them accurately, and then sand them smooth. Join the panels upside-down on a flat table with the center ribs blocked up 1 inch and the top of the tip ribs resting on the table. Block up the trailing edge at the center section so the ribs are parallel to the work surface. Make sure that everything fits perfectly, and then use slow-drying epoxy to join the wing halves.

Inside the fuselage, there's plenty of room for radio gear and the fuel tank.

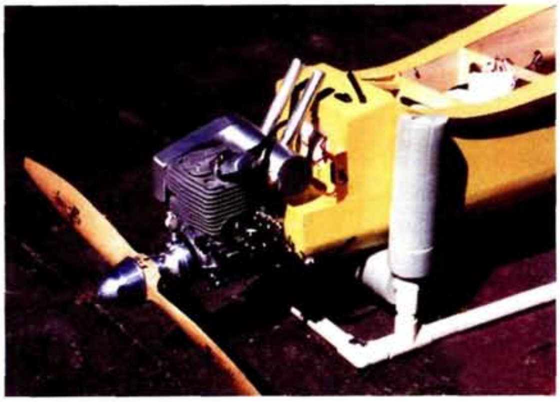
Do not build the wing with a flat top. If you do, the plane will have adverse roll coupling. The 1-inch block used under the center ribs provides the proper amount of dihedral for no adverse roll coupling; trust me on this one!

LANDING GEAR

My friend Bob Shattleroe made my landing gear out of highly tempered ¼-inch-diameter music wire, and it's much stronger than the music wire that's sold in hobby shops. The gear fairings (spats) give this airplane a lot of character. I made them out of fiberglass using two female half molds. The left and right spats are identical, and I shimmed the outboard edge slightly with foam wing-saddle material to account for the wing-dihedral angle. Position the spats carefully before you drill the dowel guide holes through the top of the spats and into the wing. Glue the dowels into place, and then drill the holes for the three 10-32 nylon attachment bolts. Tap the holes in the wing, and secure the spats in place.

PAINT AND FINISH

I covered the fuselage, fin and stab with Sig Koverall and painted the model with HobbyPoxy 2-part paint. The wing, rudder and elevator should be covered in Ultracote or MonoKote to save weight. The Sparrowhawk graphics as shown are available from Roy Weidman.



I used a Zenoah G-62 and a Slimline muffler to power my Sparrowhawk. To install and remove the narrow engine cowl, you must remove the carb from the engine.

THANKS TO ...

My good friend Bill Underkofler built both of my 88-inch-span Sparrowhawks. Bill also contributed greatly to the aerodynamic and structural design of the model.

I am indebted to Ralph Jackson, Ken Maroni and Rick Allabaugh for helping me use DesignCAD to produce the plans.

The vinyl graphics are by Roy Weidman—(607) 625-4277.

The landing gear are from Bob Shattleroe—(734) 261-9064.

C. H. Ignitions Inc. *(307) 857-6897; ch-ignitions.com.*

Horizon Hobby Inc. (800) 338-4639; horizonhobby.com.

MonoKote; distributed by Great Planes Model Distributors Co. (800) 682-8948; greatplanes.com.

Sig Mfg. Co. (800) 247-5008; (641) 623-5154; sigmfg.com.

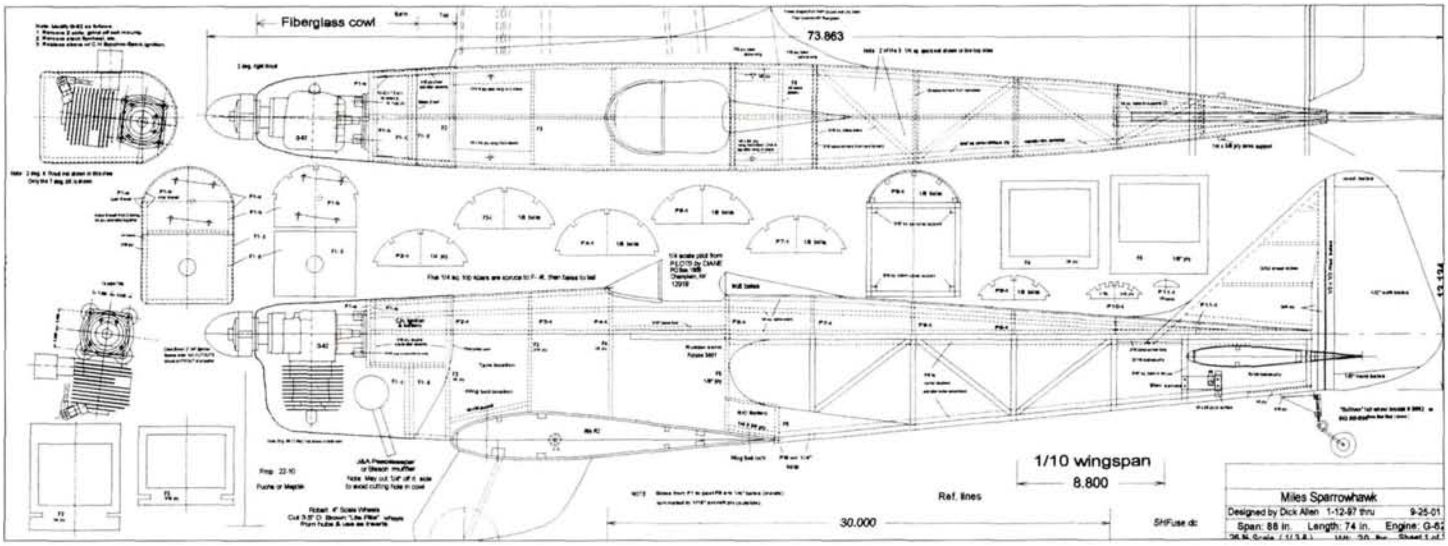
Sullivan Products (410) 732-3500; sullivanproducts.com.

Ultracote; distributed by Horizon Hobby Inc.

Zenoah; distributed by Horizon Hobby Inc.

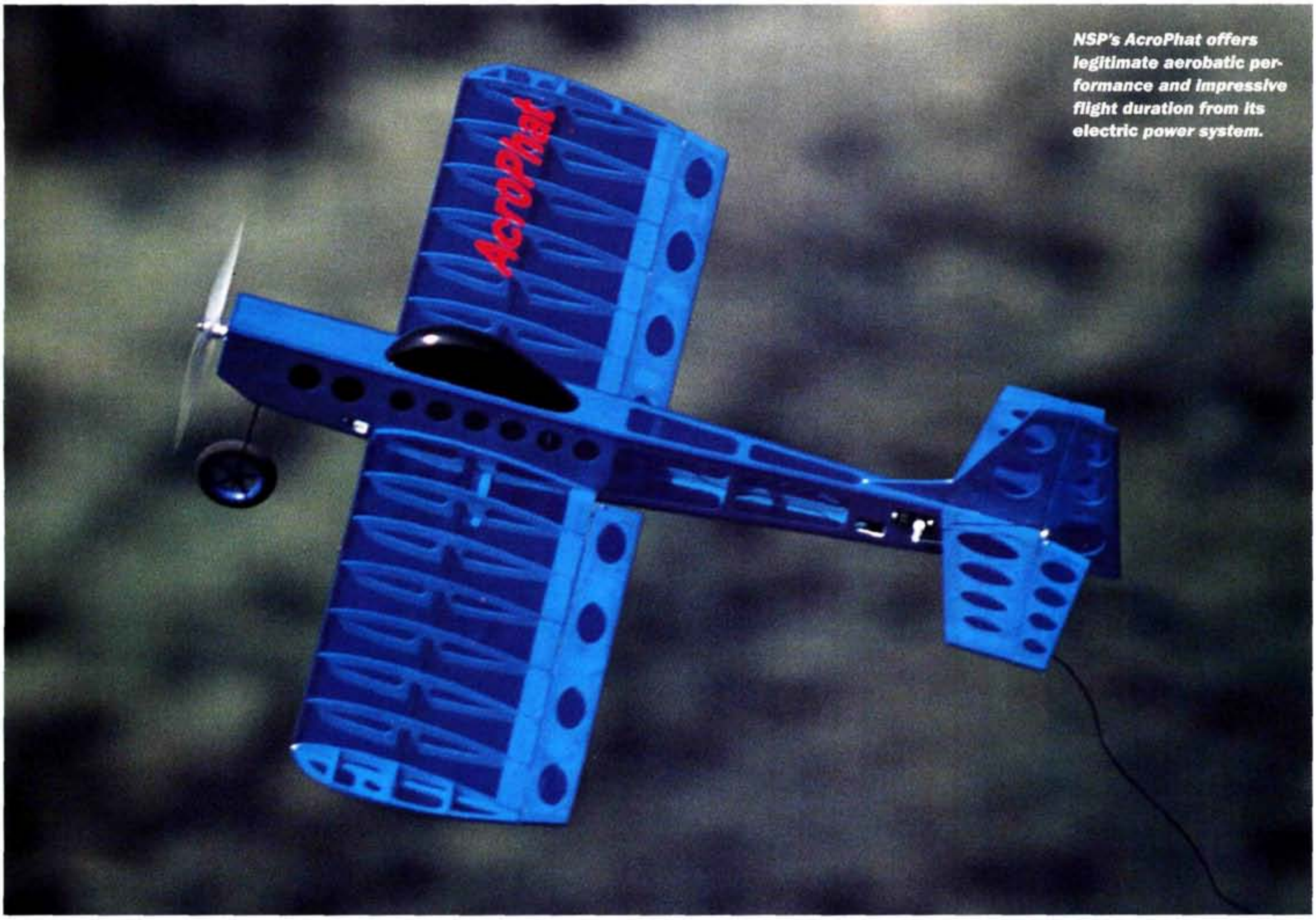
Miles Sparrowhawk FSP0503A

Designed by Dick Allen, this 26-percent-scale Miles Sparrowhawk uses conventional built-up balsa and plywood construction throughout. Foam is used to form the fiberglass engine cowl and the wing fillets, and they are formed directly on the model's structure. The Sparrowhawk is very aerobatic and is legal for both IMAC and IMAA giant-scale events.
WS: 49.5 in.; power: .25 to .40 glow or electric; 5 to 6 channels; 3 sheets; LD 3. $24.95



To order the full-size plan, turn to "RCStore.com" on page 158.

High-voltage aerobatics with the AcroPhat



NSP's AcroPhat offers legitimate aerobatic performance and impressive flight duration from its electric power system.

The Northeast Sailplane Products AcroPhat is an *electric* acrobatic plane. That may seem to be a contradiction, but electric-plane performance has improved exponentially in the last few years. Brushless motors and high-capacity NiMH batteries have made it possible to have a light, fully acrobatic electric model that can stay aloft for a respectable duration. The AcroPhat, with its carbon-fiber wing spar and leading edge, takes lightness a step further. Best of all, it comes built and covered as an almost ready to fly (ARF) that takes only a couple of evenings to complete. I find that the less time I spend building, the more time I can spend flying, and I worry less about crashing—an important attribute with an aerobatic aircraft!

SPECIFICATIONS

MODEL: AcroPhat

MANUFACTURER: Northeast Sailplane Products

TYPE: aerobatic fun-fly ARF

WINGSPAN: 40.5 in.

WING AREA: 360 sq. in.

READY-TO-FLY WEIGHT: 23 oz.

WING LOADING: 9.2 oz./sq. ft.

NO. OF CHANNELS: 4 (throttle, rudder, elevator, ailerons)

DRIVE SYSTEM USED: MP Jet brushless motor and MGM Compro TMM 18 ESC

BATTERY USED: 8-cell, 1350mAh NiMH

RADIO USED: Futaba FP-8UAP with Hitec Electron 6 micro receiver and 3 Cirrus CS-21 servos

PRICE: $159.95 (w/brushless motor, gearbox and prop)

FLIGHT IMPRESSIONS

At full throttle, the AcroPhat will climb indefinitely at about a 30-degree angle. Full throttle also gives you long (if not quite unlimited) vertical ascents. It's really nice to fly an electric plane that doesn't have a ceiling. Half throttle is all it needs most of the time, and it will stay up at only ⅓ throttle. The AcroPhat has a fully symmetrical airfoil with very little dihedral, and it flies with gratifying precision. Stalls are easy to get out of because of its plentiful power and large control surfaces. Inverted level flight requires only the slightest down-elevator. The throttle does have a little effect on trim, but not enough to cause problems.

Snap rolls are insane—especially outside snap rolls; they are so fast that

they cause the prop to cavitate. After a few consecutive snap rolls, the AcroPhat will go into a nice spin. (I would love to see this maneuver with a smoke trail.) Hit the throttle again, and everything returns to normal. An interesting flight characteristic is that its stall behavior is different when it's flying inverted. This may be attributable to the low wing mounting paired with the battery's being mounted high in the fuselage. Inverted, it will almost come to a complete hover without losing altitude, and there's only the slightest forward motion. Then, when a little down-elevator is added, it slowly turns over, hanging on the prop, and continues in normal flight; it actually appears to be flying backward the moment after vertical. Knife-edge requires full rudder that gives significant negative pitch that can be compensated for with the elevator.

The optional MP Jet brushless motor plays a big part in the AcroPhat's success. It gives the model strong climb characteristics and allows it to cruise comfortably at ⅓ throttle.

The recommended battery pack is an 8-cell, 1350mAh NiMH that gives 10-minute-plus flights with moderate use of throttle. I also tried an 8-cell, 500mAh Ni-Cd pack. Ni-Cd batteries have more voltage than NiMHs but less capacity and, consequently, less duration, even though the Ni-Cd pack I used was 1.5 ounces lighter than the NiMH. It performed as expected and gave more power than the NiMH, but only for the first 1½ minutes of flight, and the total flight time was reduced to just over 4 minutes. I prefer the NiMH pack because it provides more than enough power, and the flight times are more than twice as long.

The AcroPhat handles wind very well. This is because of its large control surfaces and plentiful power; it easily handled 15mph gusts. At full throttle, its flight speed is fast enough to make downwind turns easy. It lands on pavement just as well as any other plane, but grass landings are a bit trickier—at least, if you want a nice-looking grass landing. I discovered that when I came in too fast, the landing gear caught on the grass, and that made the plane flip. If I came in too slow, it tip-stalled and fell out of the air. Luckily, I have yet to damage anything but my pride during these landings. I've found that slow approaches under a little throttle work best. I have also brought the AcroPhat to a stall just over the ground and then added throttle for an almost vertical landing. Every time I take the AcroPhat out, I find something new that it can do.

CONCLUSION

The combination of the MP Jet brushless motor and the MGM Compro ESC is an excellent match for the AcroPhat's capabilities. The lightness, high efficiency and impressive power help the AcroPhat really stretch the envelope for electric aerobatics. If you've been dismissing the term "electric-powered aerobat" as an impossibility, it's time you had an up-close look at the Northeast Sailplane Products AcroPhat. ✈

Northeast Sailplane Products (802) 655-7700; nesail.com.

BIG POWER—NO NOISE!

The AcroPhat is powered by an MP Jet AC 25/35/20 brushless motor with a 4.1:1 gear reduction. The motor is encased in a machined-aluminum housing and is attached to a fiberglass-reinforced nylon gearbox that contains a metal pinion gear, a reinforced nylon cup gear and ball bearings; this gearbox is admirably smooth and quiet. The motor is controlled with an MGM Compro TMM 18e-3ph ESC; this motor and ESC combination is much more efficient and more powerful than brushed motors of a similar size, and it contributes greatly to the model's aerobatic capabilities. Another advantage of a brushless motor is that there aren't any brushes to break in or wear out. The ESC gives a smooth, linear output over the entire throttle range, so achieving precision control during maneuvers is quite easy.

With the 1350mAh NiMH pack, the AcroPhat stays aloft for more than 10 minutes, which is more than twice as long as any of my other electric-powered models. I have much more fun flying when I know I can get at least 10 minutes of flight; lack of duration has always been one of the criticisms of electrics, and this model certainly goes a long way toward addressing that complaint. When I am easy on the throttle, I can actually get 20-minute flights, but what fun is that when you have an acrobatic plane? I noticed a power increase when I charged the battery at 2.7 amps and flew with a warm battery. Charging at 1.3 amps did lead to longer flights, but an hour to charge is a long time to be on the ground.

The ESC has two programmable settings: brake or no brake. Brake is used to collapse folding props, but that setting may cause damage to gearboxes. Since this model uses a fixed prop and gearbox, I chose to disable the brake. This setting has to be set each flight whenever the ESC is turned on. Before you switch on the plane, set the throttle stick to full and then power up. After you've heard two beeps, move the throttle stick all the way down, and then wait for a single beep. Reverse the procedure to enable the motor brake. This initially seemed cumbersome to me when I read the instructions, but it became second nature after I had turned on the plane a couple of times. It's also a good safety feature because the motor will not turn over until the ESC has been programmed, so you can never accidentally switch the plane on with the throttle open.

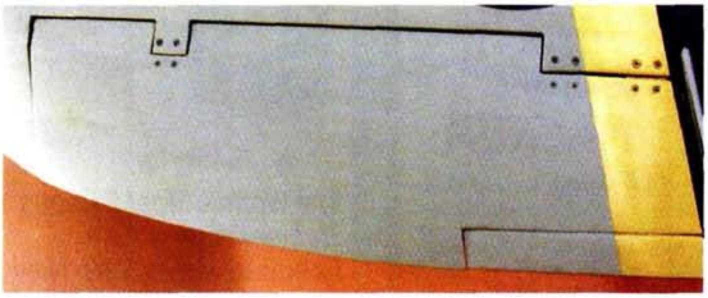
by Vance Mosher

Control-surface hinging

Aside from the ability to get airborne, the most basic requirement for any flying machine is attitude control. With this in mind, let's talk about hinges—the little things that allow the control surfaces to move—and how to make them work properly.

On a scale model, the best hinges are those that work the way full-size ones do. Scale functioning hinges allow the control surfaces to move like the real ones did, and this is an important detail if you want maximum static-competition points. On WW II fighters, for example, the control-surface hinges were inset to help counterbalance the control surfaces so the pilot could handle the loads. In this case, the scale-hinge arrangement adds to the static score while decreasing the servo loads—both good things!

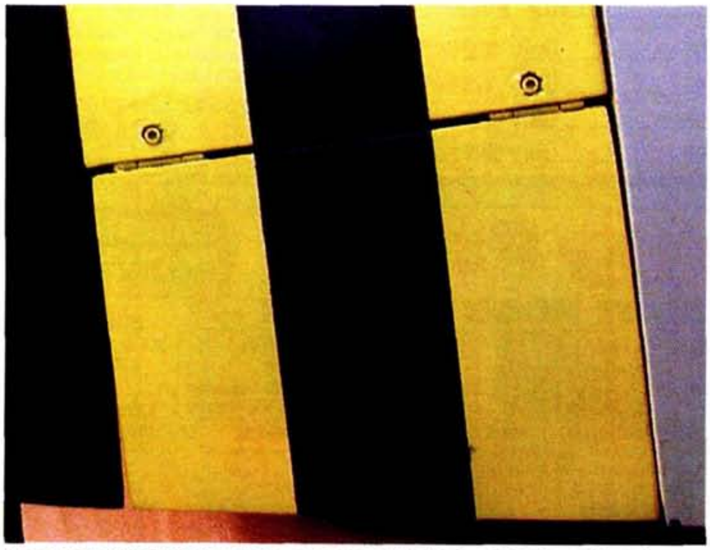
The author's scale Westland Wyvern is an unusual subject; it uses removable, scale functioning hinges as described in this column.



Inset hinges such as these are scale in appearance, and they help relieve servo load by counterbalancing the control surface.

A good hinge is friction-free; the control surface will flop around from its own weight. Stiff Mylar sheet hinges won't allow this, and they aren't recommended for scale models.

- A good hinge is stiff, with no unwanted motion (slop) between the servo and the control surface or between the control surface and the surface it is attached to, even with a reasonable load applied to it.
- A good hinge provides a seal and doesn't allow airflow through the hinge line. Airflow reduces control effectiveness and produces higher drag and higher servo loads. This produces erratic control response, and your model "jumps around" and becomes difficult to trim.



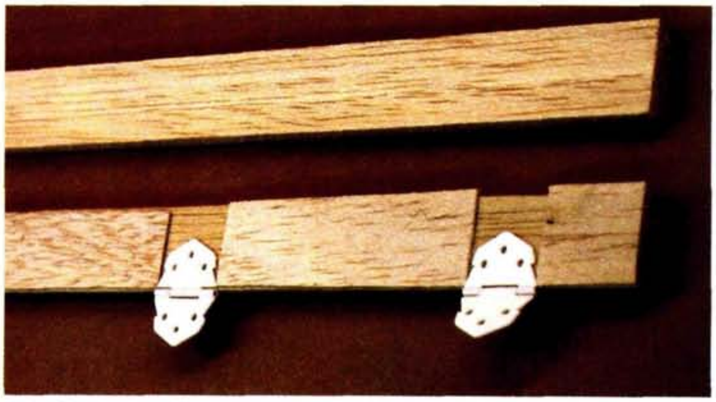
These removable hinges (note setscrews) make it easier to paint and, if necessary, repair the model.

COMMERCIAL HINGES

Though not as effective as scratch-built scale hinging, commercial hinges are suitable for sport scale. To minimize control binding, all the hinges must have their hinge pins in a perfectly straight line. The best way to achieve this is to make an assembly jig to hold the hinges in alignment and with the correct spacing. Using a jig also lets you test the hinges' action before you install them in the model.

THE HINGING JIG

Make the jig out of straight pieces of balsa. The base sheet should be as long as the control surface and about 1x¼-inch thick. Sheet balsa is preferable to stick balsa because the thin edge can be trimmed to a straight line, and it doesn't readily bend across its width. Thick sheet



This simple hinge jig keeps the hinge pins aligned with each other as the hinges are installed in the control surface.

VANCE MOSHER: SCALE MODELER EXTRAORDINAIRE

Vance has been a model builder since 1943, when he started school and saw his first model airplane. As an adult, Vance became a pilot and built a full-size Pazmany PL-2 experimental homebuilt, which he flew for several years. According to Vance, building the Pazmany interested him much more than flying it.

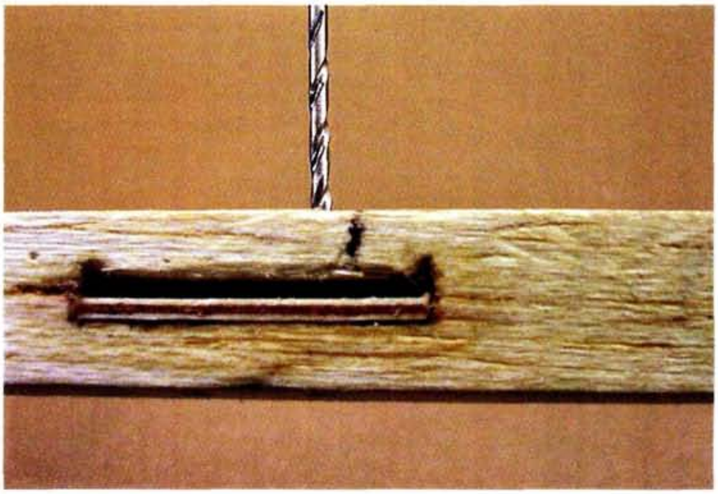
Preferring scale models, Vance likes his models to look and fly like their full-size counterparts, and they have to fly well. His favorite aircraft are propeller-driven military aircraft, and he really likes twin-engines. Vance strives to build his models straight and light, and he wants them to be accurate and unusual. He likes his models to create an impression of realism, rather than just qualify for the rules of a scale contest. And he likes his models to build fast. His modeling preferences compel him to design and draw his own plans and components and to develop new building processes. We are pleased to have Vance as a guest columnist because he thinks writing articles about scale models is also fun. We have to agree! —*Gerry Yarrish*

is more likely to remain flat. Bevel the hinge side about ⅔ of the width to allow the hinges to move, but try not to alter the straightness of the edge. To keep the jig parts straight, glue them together on top of a flat surface. I use 3M-77 spray adhesive to glue the parts together; to take it apart later, I soak the jig in thinner. This allows me to use it again with different hinge spacing.

Don't get any glue on the hinges; otherwise, you won't be able to remove them from the jig. Place the hinges along the beveled edge, tight against the edge and spaced apart as required. Fill in the spaces

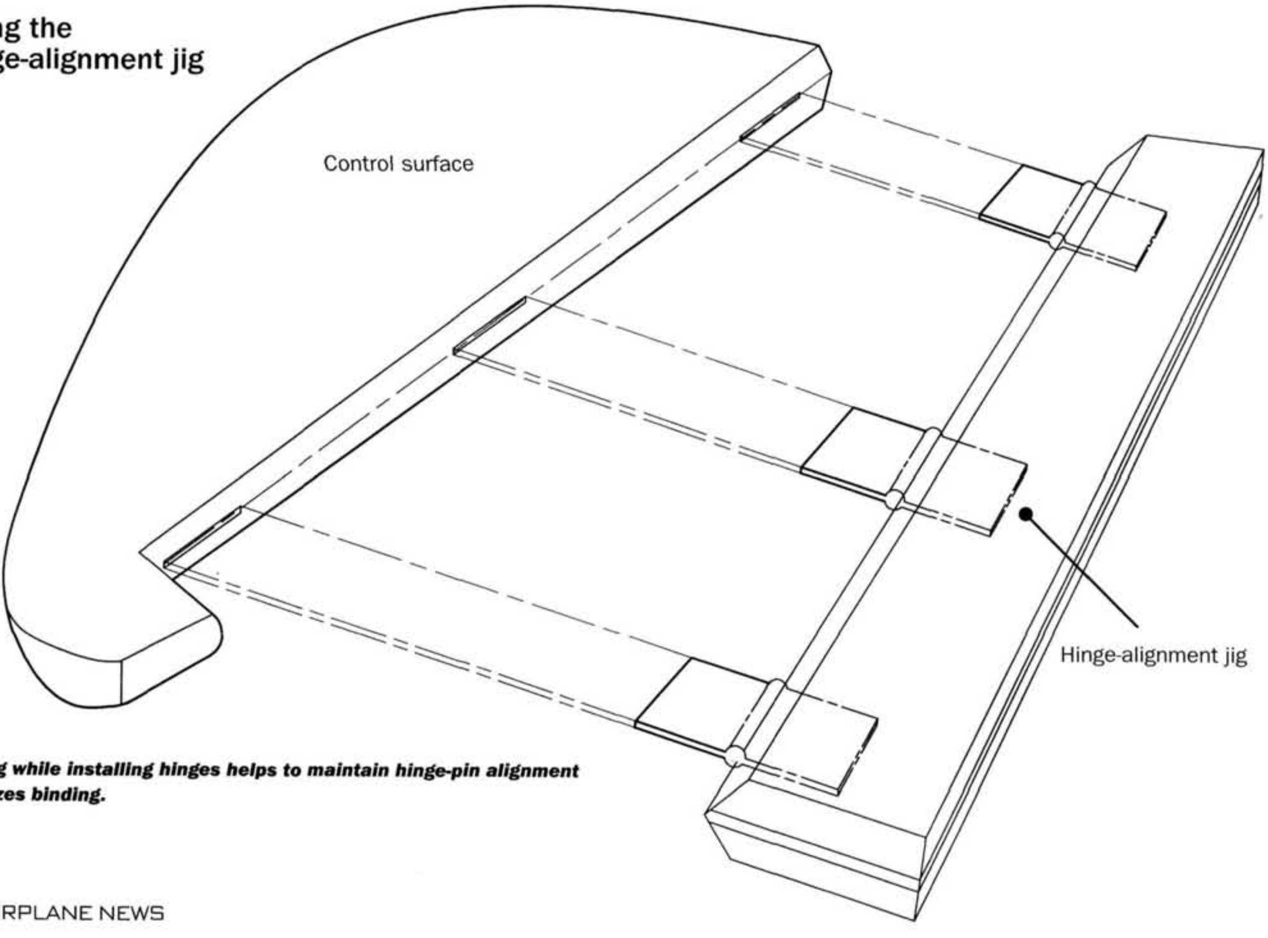
Here, the hinges are in the jig and ready to be inserted in the slots that have been cut into the model.

between the hinges with balsa sheet that is the same thickness as the hinge. Remove the hinges, and complete the sandwich by adding another hard, straight piece of balsa (as wide as the hinges) on top of the jig. Then bevel the top of the front.



To make hinges removable, install a thin plywood plate as shown, and drill holes through the bottom of the surface into the plate but not completely through to the other side.

Using the hinge-alignment jig



Using the jig while installing hinges helps to maintain hinge-pin alignment and minimizes binding.

The small screws pass through the holes in the hinge tabs, and their heads are flush with the underside of the supporting surface.

USING THE JIG

Use contact cement to hold the hinges in the jig. Let the cement dry for a few minutes before you place the hinges in the slots. Use the jig as a guide to mark the hinge-slot spacing in both the control and the supporting surface. A long knife blade makes a good marker. Use a straightedge to check the alignment of the slots in both the control surface and the supporting surface, and then cut the slots in the control surface and the supporting surface with a sharp hobby-saw blade. To widen the slot so the hinge can slide in freely, just push it in and twist it back and forth while cutting.

To prevent glue from binding the hinge pin, dip it in melted paraffin or beeswax. Fold the hinge tabs tightly back on themselves, and dip just the barrel into the melted wax. (Don't get any wax on the gluing surface.) Replace the hinges in the jig, and lightly apply slow-setting epoxy or Pacer Hinge Glue in the hinge slot with a knife blade. Smear a bit of glue on the hinge tabs, and glue all the hinges into the control surface (while they are still in the jig). Wipe off any glue that has squeezed out, and allow the adhesive to cure. When the glue has dried, remove the jig from the hinges.

THE REMOVABLE SIDE

Permanently installed control surfaces are hard to work around, so to make it easier to paint and repair the model, I make my control surfaces removable. I use socket-head sheet-metal screws instead of glue to hold the hinges in the slots. Lengthen all the hinge slots in the supporting surface about 1/4 inch at each end. Enlarge the slots to 1/16 inch wider than the hinge tab. Make all the enlargements on the top side of the hinge line. Cut pieces of 1/16-inch birch plywood about 1/2 inch wide by 1 1/8 inches long, or roughly the same length as the slots. Glue these pieces into the tops of each slot, leaving room for the hinges centered along the hinge pin. Hold the control surface in place, and position it so that there is clearance at each end. Press the hinges tightly against the fixed surface's trailing edge, and press the hinge tabs against the underside surface.

When the pocket is in place, the slot must be filled with balsa between the setscrew and the surface's edge.

To determine the position of the hinge-support screws, mark through the holes in each tab. Use the two holes that are parallel to the hinge line. You need only one hole in the center of the hinge tab for .25-size and smaller models. Remove the hinges, and with a 1/16-inch bit, drill through the underside surface and through the plywood plate, but don't go all the way through to the opposite side. Next, enlarge the hole opening with an 1/8-inch drill bit so the screw heads fit flush with the underside surface; then harden the holes with thin CA.

Slide the hinges into the slots, line up the control surface from side to side, and secure each hinge with no. 2 sheet-metal screws.

HINGE POINTS

Robart Hinge Points require drilled holes in the control and support surfaces instead of straight slots. A jig makes it much easier to align these holes as well. Be aware that since they are round, Hinge Points can rotate (twist) within their attachment holes. If you glue them into place before their pins are properly aligned with each other, they will bind. To check their alignment in the jig, bend the portion that sticks out at a 90-degree downward angle.

To install Hinge Point Pockets, you must enlarge the hole and cut a slot above it so you can slide the Pocket into place.

To make the hinges removable, you must install Hinge Point Pockets into at least one side of the joint. The holes must be enlarged to allow the Pockets to fit, and you need to flare the hole openings to a rectangular shape and inset the opening 1/4 inch to properly position the hinge pin. Drill a vertical 1/8-inch hole in the underside of the hinged surface (in the horizontal hole), 5/16 inch back from the edge, and then cut an 1/8-inch-wide slot back to the hole. Install the Pockets, and fill the slot with balsa. Slip the Hinge Points into the Pockets, and flex the control surface to test the alignment. Remove the hinges, and glue the Pockets into place by wicking thin CA around them. Tighten the setscrews (one full turn) to hold the hinges in the Pockets.

Properly functioning, scale-like hinges aren't difficult to install if you know the proper technique. Give these suggestions a try, and see for yourself! You'll be glad you did. ✈

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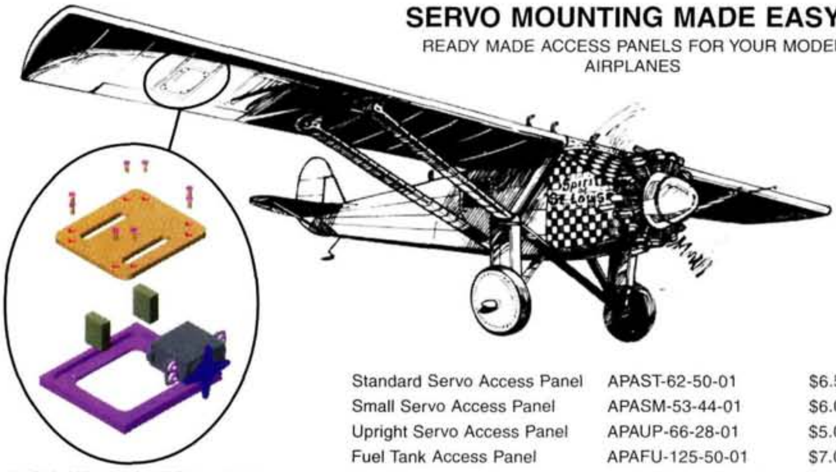

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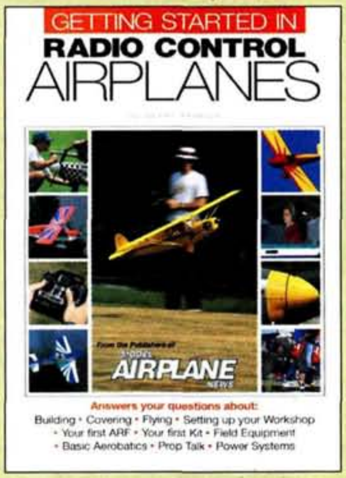

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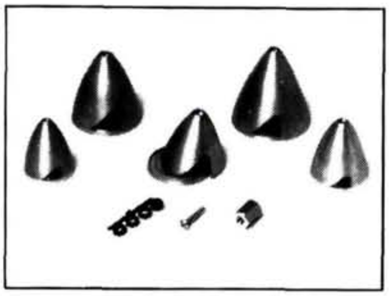

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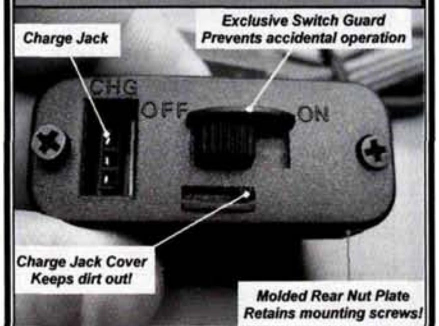

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BY JAIME LAGOR

Boeing X-45A
21st century warbird

The X-45A successfully completes one of its first test flights.

The emergence of highly capable unmanned aerial vehicles (UAVs) such as the now-famous Predator is proving that the future of military aviation may be decidedly radio controlled. The ability to survey landscapes and track potential targets with minimal risk to human life is essential to any successful military operation. Soon, we may be able to add one more task to the growing list of UAV capabilities.

In September 2000, the Boeing Aircraft Corp. introduced the X-45A unmanned combat aerial vehicle (UCAV); it's the first unmanned system designed from inception for combat. Jointly developed by Boeing and the Pentagon's Defense Advanced Research Projects Agency (DARPA), the 44-foot-wingspan X-45A features a sleek, futuristic-looking airframe and is capable of carrying 3,000 pounds of ordnance into combat.

The X-45A is the prototype for what Boeing and DARPA envision to be the first truly robotic warplanes. It represents the future of unmanned flight.

Although it isn't the first UAV capable of carrying weapons, the X-45A is the prototype for what Boeing and DARPA believe to be the first truly robotic warplanes. Developers of the X-45A envision fully capable UCAVs that can select the target, choose how best to destroy it and, of course, carry out the mission. Ultimately, they hope the X-45A will be able to knock out enemy air defenses and conduct precision strikes with greater accuracy than any previous aircraft, and because the X-45A does not require an onboard pilot, there is zero risk of U.S. casualties.

In addition, such a vehicle would prove even more advantageous when pitted against a piloted vehicle. A UCAV could perform aerial maneuvers and endure G-forces that would incapacitate an enemy pilot. It also costs about a third less to build and maintain than today's fighters.

Although the program is still in the early stages, the X-45A has already successfully completed several test flights and continues to expand the flight envelope and demonstrate increased combat capabilities with each flight. We may see descendants of this now one-of-kind UAV head into battle as early as 2010. ✈